NEVARC NEWS   VK3ANE

Next Club Meeting
Sunday 14th July
Belviour Guides Hall, 6 Silva Drive West Wodonga

Meetings commence with a BBQ (with a donation tin for meat) at 12pm with meeting afterwards
Members are encouraged to turn up a little earlier for clubroom maintenance
Call in Via VK3RWO, 146.975, 123 Hz tone

"Calling CQ DX on 13cm, just upped power to 180 watts, can you copy now…?"
This is part of Melbourne club EMDRC JMFD setup, read all about it this issue

A SERIOUS PRESENTATION ON ALL THINGS MICROWAVE

Several weeks back Mick VK3CH attended a presentation from two hams from Melbourne EMDRC.
Damian VK3KQ, Peter VK3QI from EMDRC gave a two hour talk on their exploits on the microwave amateur bands. Bernard VK3AV from NERG also gave a demonstration on his reasonably simple 2.4GHz transmitter setup.

Spanning well over 10 years' worth each of experience, experimentation and home brew gear between them, Damian VK3KQ and Peter VK3QI had a wide range of homemade gear used on the EMDRC John Moyle Memorial Field Day.
This explains why they either win it or are near the top year after year.

I didn't ask how much worth of dollars was on display but I cringe to think of its combined value, try $10,000+

Between them they have;   [This is the official EMDRC version 3 system]

Band	Wavelength	Output Power
1.2GHz	23 cm	180 watts
2.4GHz	13 cm	120 watts
3.4GHz	9 cm	20 watts (soon to be 60 watts)
5.7GHz	6 cm	50 watts
10.3GHz	3 cm	30 watts

Also controlled outputs for;

24GHz	12 mm	
47GHz	6 mm	
78GHz	4 mm	

Everything is GPS locked with a 10MHz reference, they say when they change bands with the same station the pitch of their voice on receive does not alter at all, no 'clarifying' required.
They say on weak signals, at least knowing that both are right on frequency, just focussing your dish antennae is all that's left to do to hear them.

All of this is remotely operated from the tent they have on site for the John Moyle Memorial Field Day, with power on the mast, to reduce power cable losses.

More features are;

Uses a variety of relay and FET DC switches for RX to TX changeovers to protect everything.

Properly sequenced and controlled feed point preamps for 5 bands.

5 band feed RFHamdesign to 1.8 meter dimeter prime focus dish.

28 volt power supply with 28/12 volt built-in converter.

145MHz IF (5/10 watts) for 2.4GHz and upwards from TS2000X.

1.2GHz (5/10 watts) for 1.2GHz amplifier from TS2000X.

Remote monitoring of 12 volt current.

Only 5 cables each up to 15 meters long from tent to mast;

- FSI 4-50 (1.2GHz)
- Heavy caravan cable (28 volts)
- RG213 (145MHz)
- 13 conductor (control 1)
- 7 conductor (control 2)

PROPER SQUENCING

Points to remember…

Most SMA and N relays – allow 15 milliseconds
Most waveguide switches – allow 150 milliseconds
Most rigs have 20 to 30 milliseconds delay available
Best to have a dedicated 4 port sequencer with variable delay

Sequence

1. Disable masthead preamps
2. Switch Transmit relays to transmit
3. Switch appropriate FET amp switches on
4. TX: 0 or TX:+12 on transverters and amplifiers

GPS 10MHz LOCKING

In the past they have used the Trimble Thunderbolt units with the VK4GHZ display units, but the cost is becoming prohibitive and Adam no longer produces the display units.
There are cheaper display units on EBay, but who wants to spend their time sitting and watching a display?
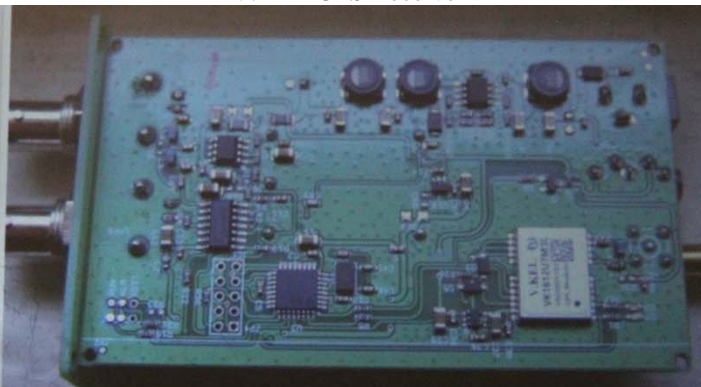
A better alternative is:

RFConcepts GPS 10MHz Sine Wave with indicator lights – approx. AUD $100

Green OFF	Red OFF	-	No power
Green FLASHING	Red ON	-	Power on, searching for satellites
Green ON	Red ON	-	Found satellites – internal 10MHz <0.1Hz
Green ON	Red OFF	-	Fully GPS locked 10MHz >0.1Hz accuracy

Vectron C4600 OCXO   V.KEL GPS Receiver

VK3CL LOGGING OF MICROWAVE BANDS

PROBLEM - how do you get VKCL to recognise all the microwave bands when you are using a single 145 MHz IF?

Mike VK3AVV came up with the idea of a Tctec Top16 USB I/O module

Generic interface to output devices such as relays, solenoids, strikes, low voltage lamps, unipolar stepper motors.
Read inputs from sensors and switches.
8 x Current sinking (switch to ground) outputs, 250mA to 30 Volts
Individual PWM control on all outputs
8 x Simultaneous Digital (0 -30 V) & Analog Inputs (0 -5 Volt single-ended 12 bit)
USB powered

http://www.mnds.com.au/vkcl/Transverter//transverter.htm
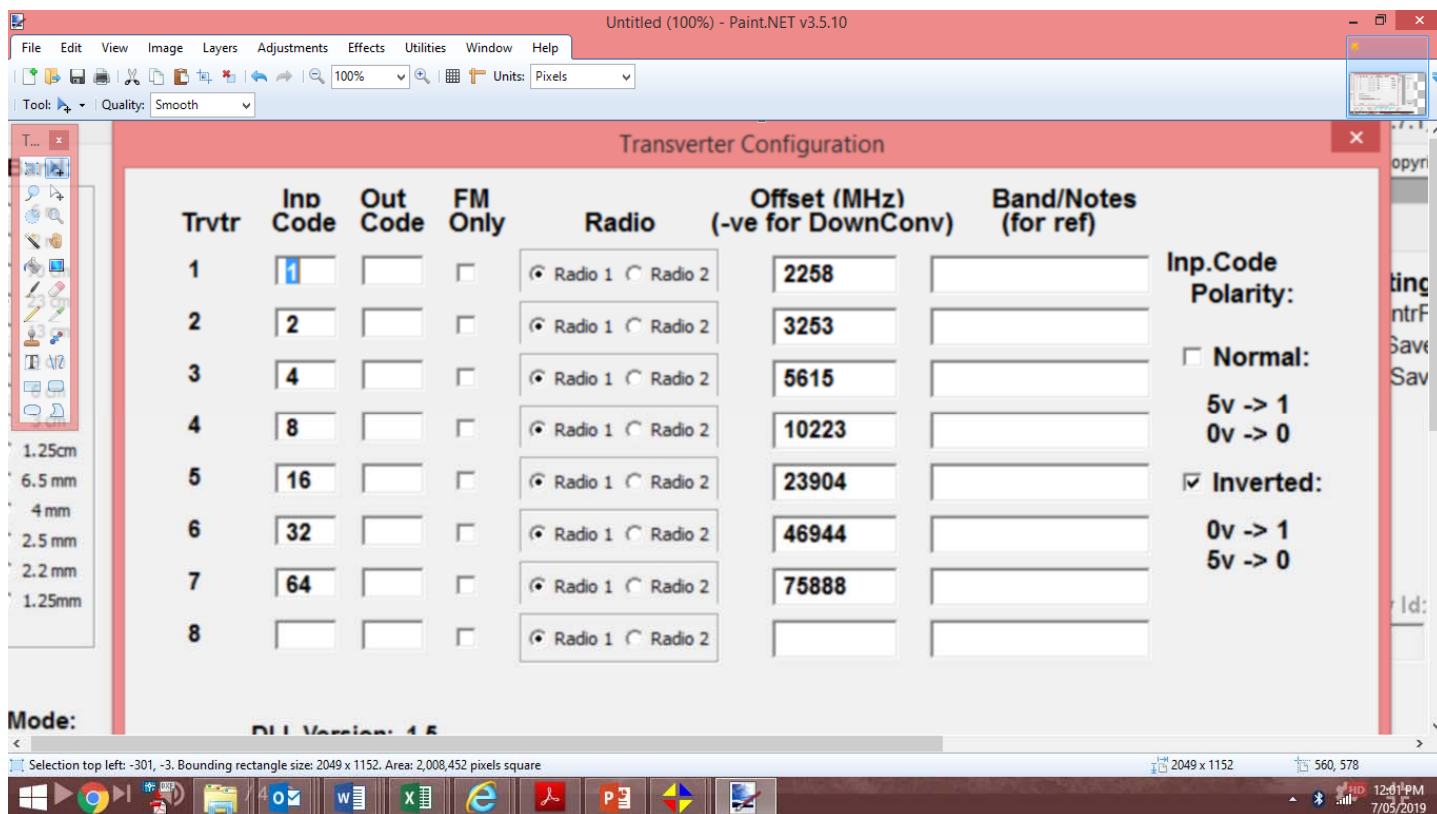
Tctec   TOP 16 USB I/O Module
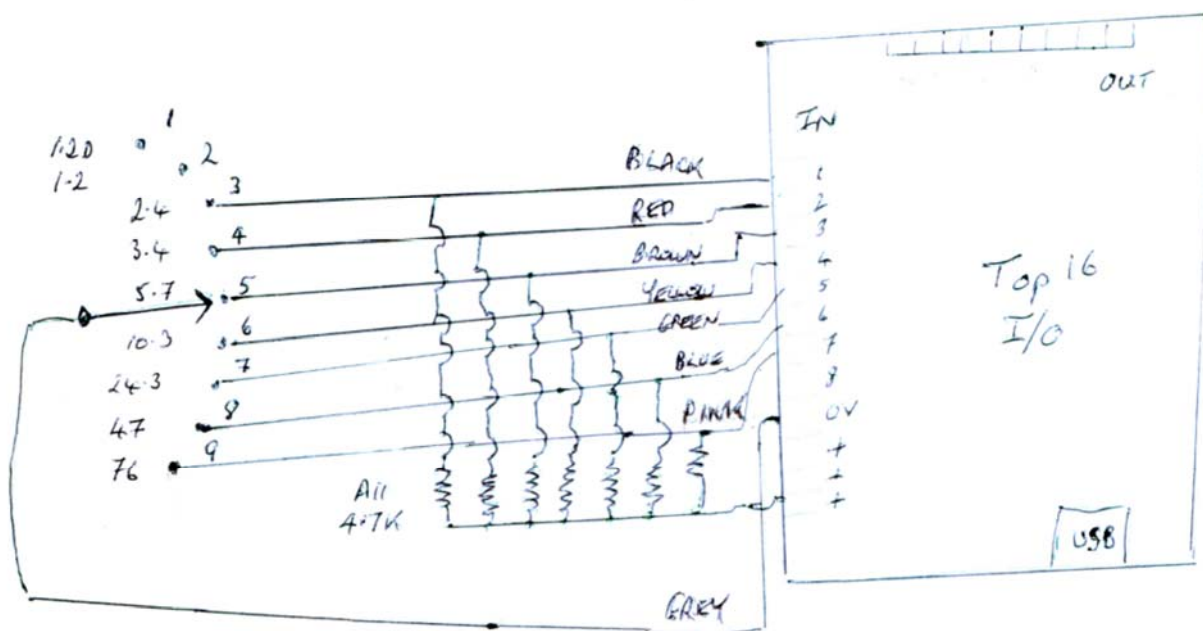
CABLES PLUGS and SOCKETS

- A good source of multicore cable – in the past we have used caravan cable –> 7 core
- RS supply a better version with a larger centre wire (6 + 1)
- What if you want more conductors? Security cable is limited in current capacity.
- A better source is TORA irrigation solenoid cable 7 or 13 conductors 0.5 square mil = 5 amps per conductor – suitable for direct burial.
- Waterproof plugs and sockets – in the past we have used Amphenol
- IP68 SP21 Aviation plugs and sockets are just as good and MUCH CHEAPER - sources aplenty on Ebay from 2 to 12 pins
- Preferred supplier is industry shop in Hong Kong about A$6 a pair

- https://www.ebay.com.au/itm/IP68-SP13-SP21-2-3-4-5-6-7-9-12Pin-Waterproof-Plug-Socket-Connectors-HighQ/173351620960?hash=item285c8fd160:m:mmT8EnoGPMf6nN4wD_NjLCw

- http://www.weipuconnector.com/UploadFiles/File/2013-2-20/6349698055795312506322.pdf

GPS LOCKED FREQUENCY SYNTHESISERS

- The DEMI transverters have a variety of programmable frequencies available for all the different frequency combinations. We used 145MHz as the IF for all bands from 2.4 to 47 GHz.
- However when 3400 MHz and above became unavailable we had to move to 3398 MHz and this meant an IF of 143 MHz which was annoying. To get back to 145 MHz required a frequency of 3253 + 145 = 3398 Mhz.   The oscillator required is 3253/3 = 1084.3333 MHz but this frequency was not pre-programmed and N5AC, who had developed the oscillator for DEMI was not prepared to make any further changes to the EEPROM.
- There is very little available at reasonable cost that is <u>fully</u> and <u>easily</u> programmed **and 10 MHz GPS lockable** , until I checked with VHFdesign https://vhfdesign.com/

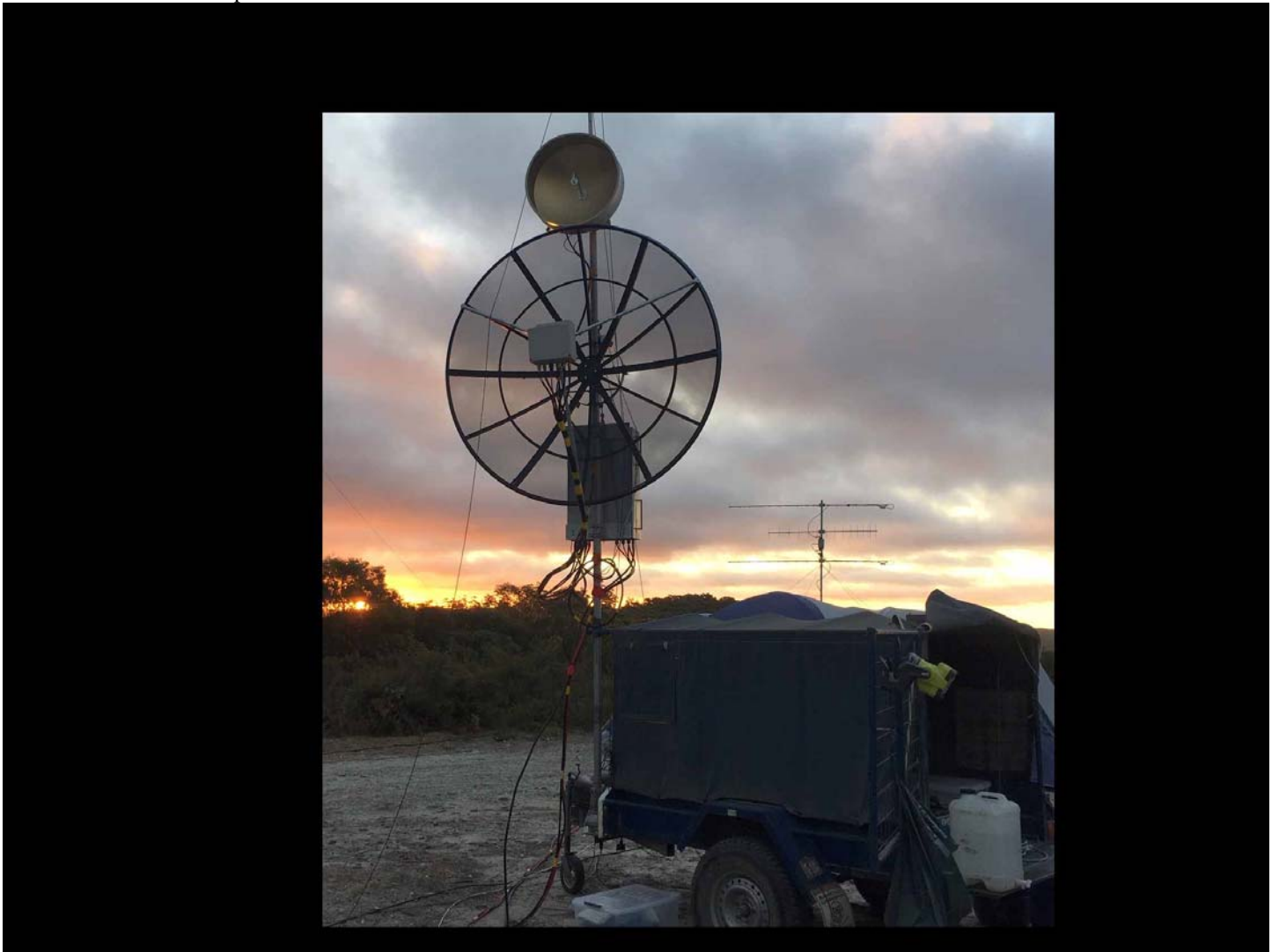The synthesiser uses either a   ADF4350 140 → 4400 MHz
                                        Or ADF4351   50 → 4400 MHz
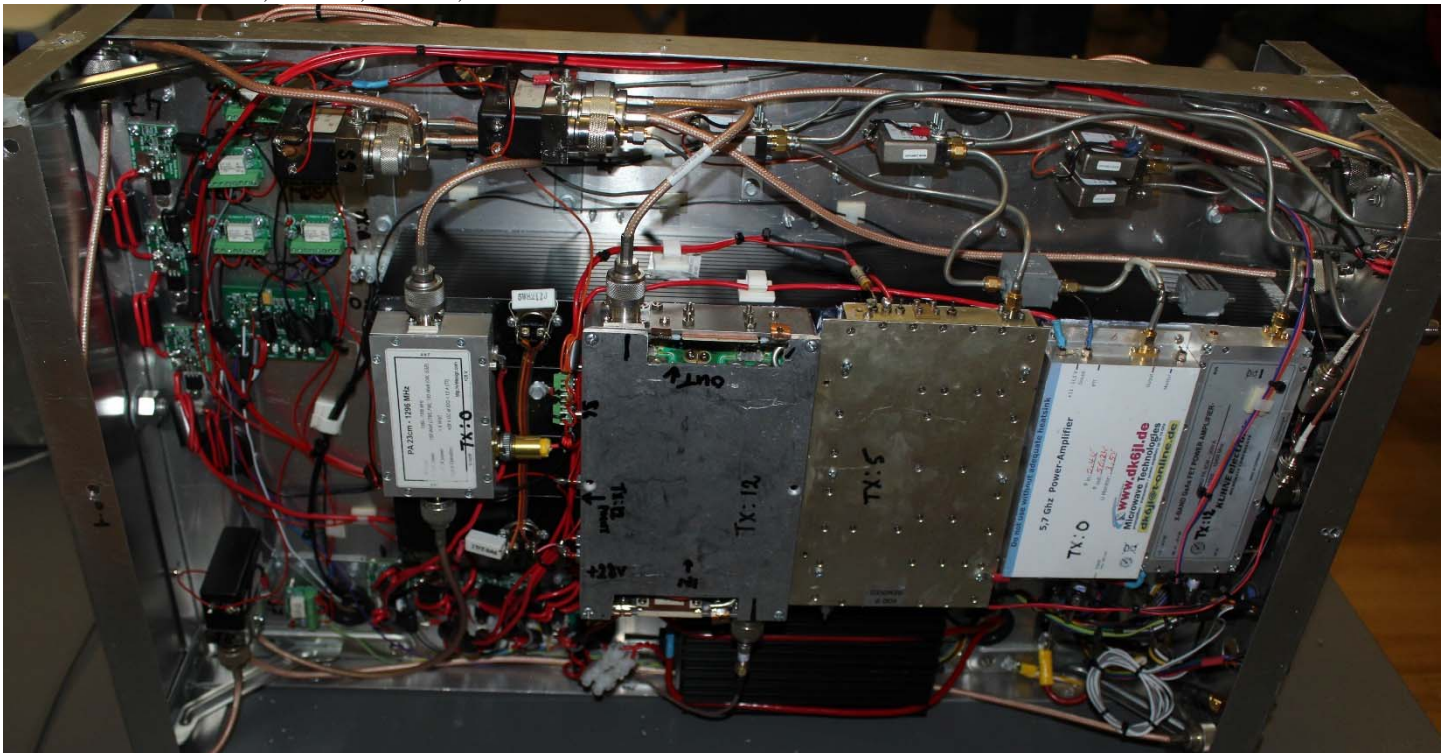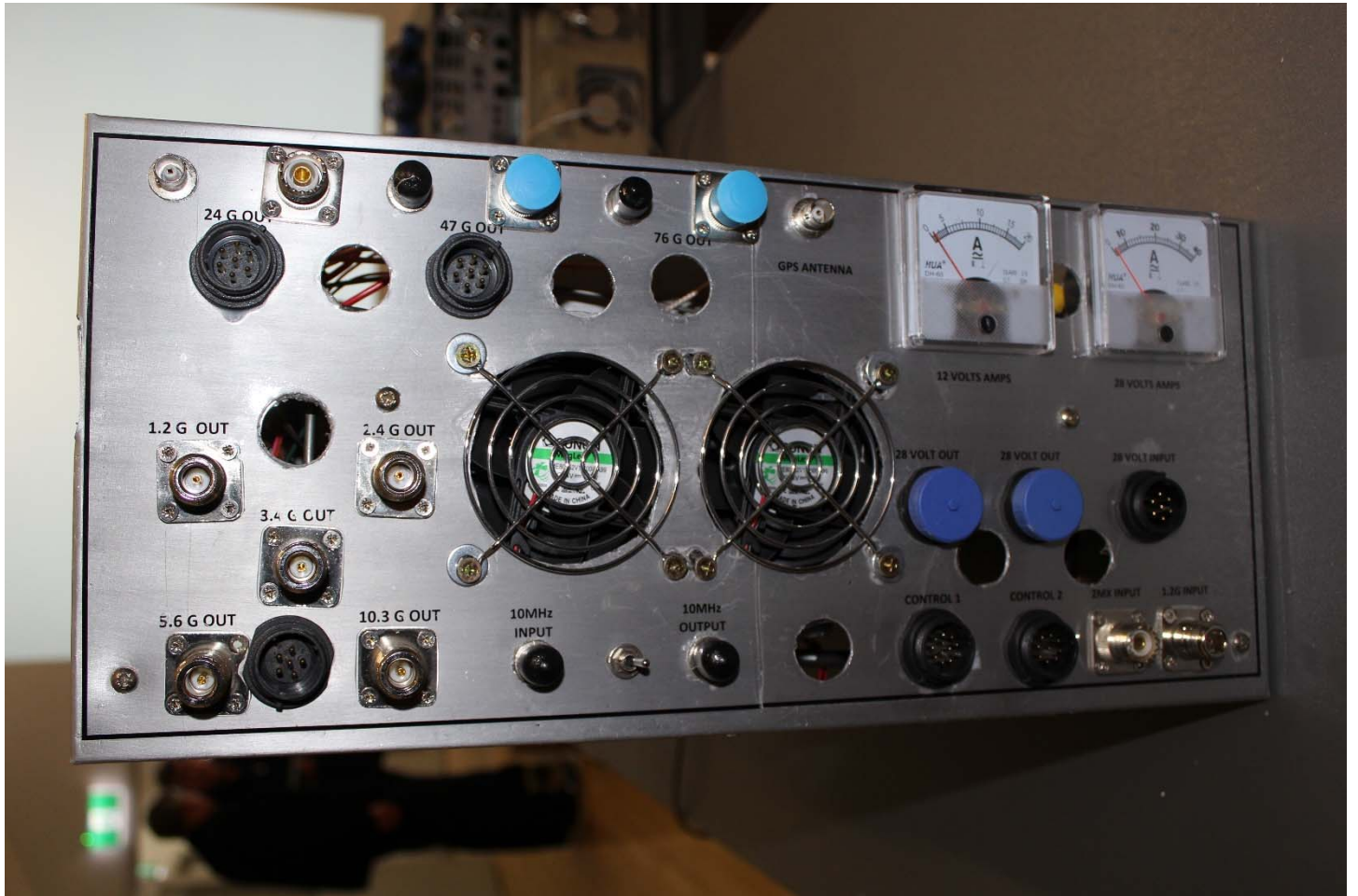   Or MAX2871   50 → 6000 MHz

But it does more than just produce a single frequency.

Part of the EMDRC setup

The PA unit for 1.2GHz, 2.4GHz, 3.4GHz, 5.7GHz & 10.3GHz

Rear of the PA unit

Another unit for 1.2GHz, 2.4GHz, 3.4GHz, 5.7GHz & 10.3GHz
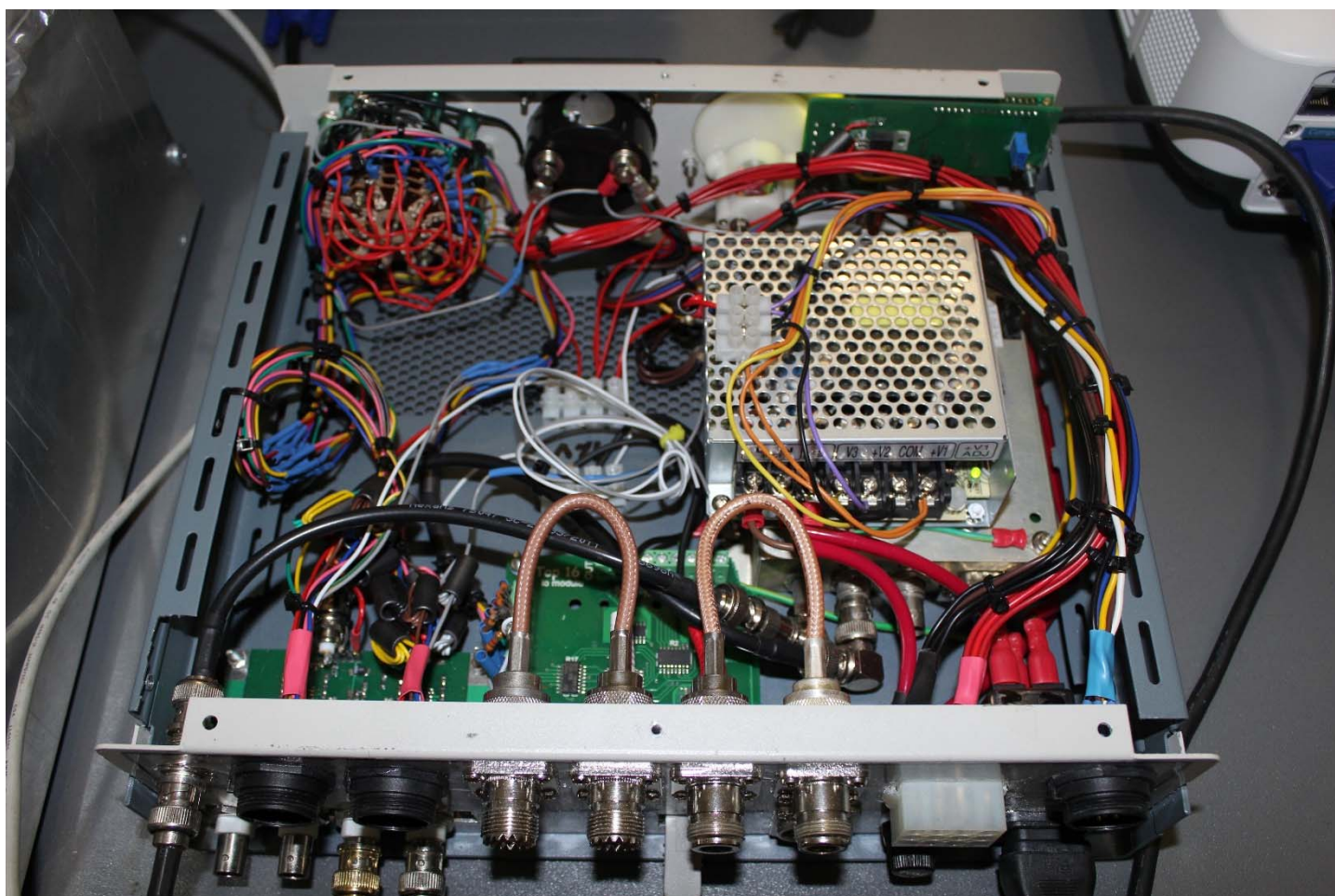
Kuhne MosFET Preamp units

Damien said that prior to getting the millisecond timing right on his sequencer, he managed over a few years to kill a few preamps, which in his words, was an expensive way to learn, getting the timing right, when switching RX to TX and back.

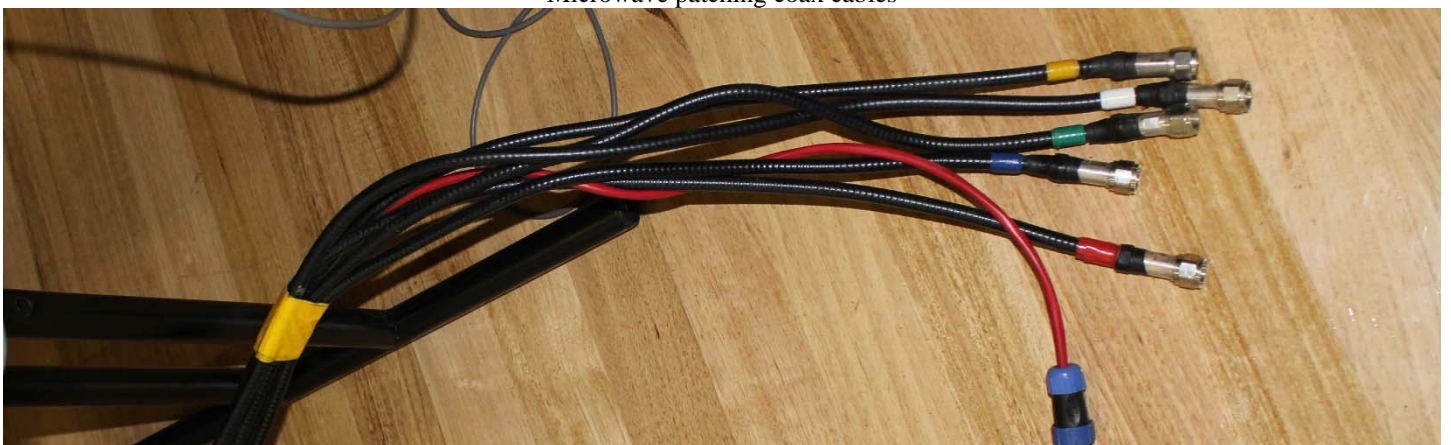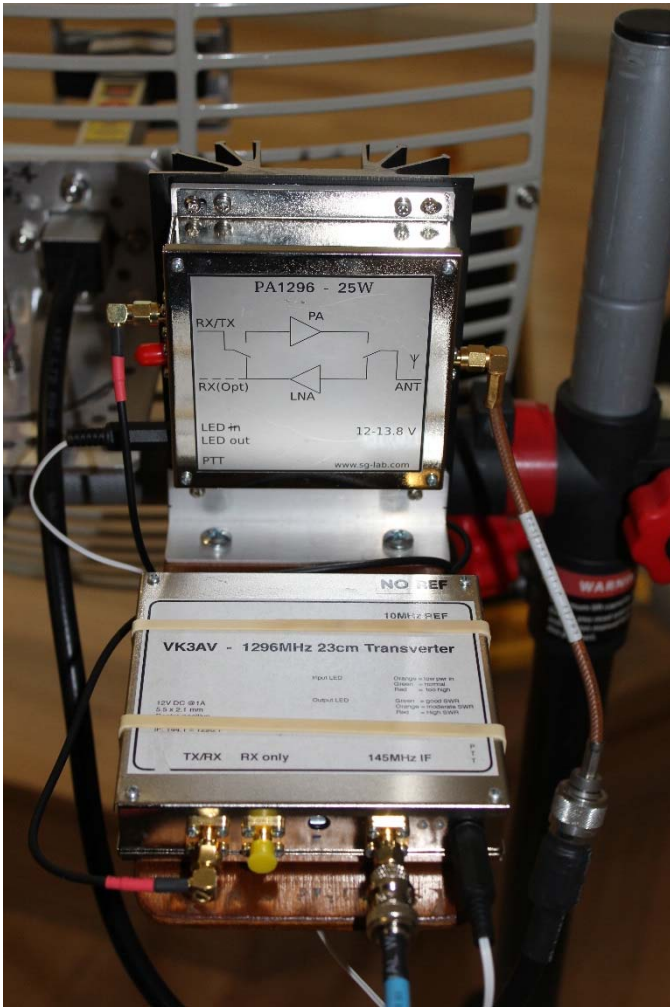Kuhne equipment is superbly made quality precise stuff, but at a cost.

Damien's 24GHz dish setup

Microwave patching coax cables

23cm Transverter with an IF of 146MHz

The crew inspect the 23cm grid pack dish

Close-up of grid pack dish feed

Many useful tools available as iPhone apps and also found on the internet.
Hepburn Tropo Index just one of many.   http://www.dxinfocentre.com/tropo_aus.html
It was an excellent show and certainly puts expensive ideas into your head.

~Mick VK3CH

VK3CM Winch Cable Saga

A couple of photos of why we check our towers here in North East Victoria, as a matter of routine.
We suffer huge winds here and we like to think we are always on top of the situation, but not today.

Every month, our antenna towers are dropped to the ground for a look at how everything is fairing.
This includes RF cables, Samantha found one RF cable a cockatoo had got to... doh!!!
Antenna mounts and the most important one, winch cables.
Every tower has a weak point and knowing your tower, especially if you are loading them up with huge Optibeams is essential.
And to show it's a team effort, Samantha spotted this first, so I was just so thankful it didn't snap while we were lowering, it would have been a very quick run from under the falling Optibeam for the both of us.
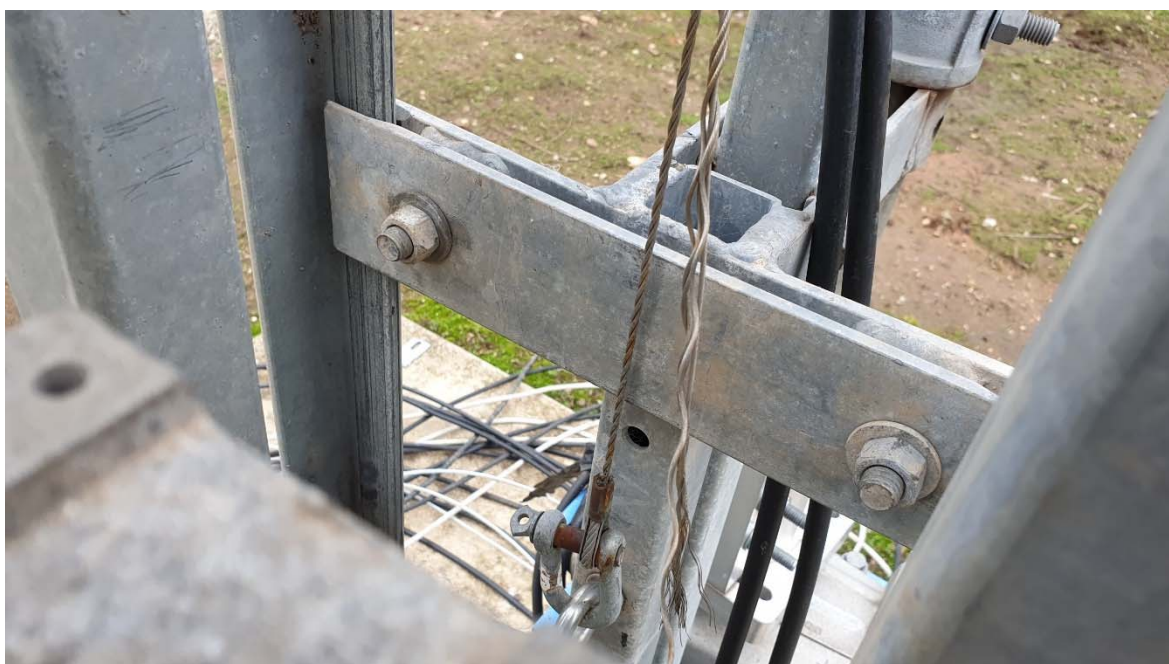
Some would say, what a pain we have to replace the winch cable, but for me, it was a sigh of relief as the rotator is $3500 and the antenna over $7000 now, and all of it would be toast if this pictured cable snapped while we were dropping the tower to the ground. This tower will be down for a few weeks, we are doing a few upgrades including upgrading the size of the winch cable, I have been meaning to do it for months, and now it's a must.

Be careful with your antenna installations, they can bite if they don't get maintenance.

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                                                                                                    ~Brenton VK3CM

YOU COULD BE EATING A TEASPOON OF MICRO PLASTIC EVERY WEEK

A new study has found that the global average of micro plastic ingestion could be as high as five grams a week per person, which is the equivalent of eating a teaspoon of plastic — or a credit card — every week.

The study was commissioned by the World Wide Fund for Nature (WWF) and carried out by the micro plastics research team at Australia's University of Newcastle.
It collated the findings of 50 international research papers in an attempt to provide an accurate calculation of ingestion rates.
It found that based on "conservative assumptions" that people are consuming about 2,000 tiny pieces of plastic each week.

The study focused on micro plastic less than 1mm in size, which are the most commonly ingested contaminants.

Water is the main source University of Newcastle researcher Thava Palanisami said water, both bottled and tap, was the largest single source of plastic ingestion. "In water it's mostly fibres which could come from industrial activities," he said. "It's released with other gases and chemicals and this can then ultimately sink into the freshwater bodies and that gets into the drinking water. " And there are no filtration systems for bottled water that could filter out those sub- micron phase particles."
One study confirmed that bottled water from groundwater sources was mostly free of plastics, Dr Palanisami said.
Of the consumables studied, those with the highest recorded plastic levels included shellfish, beer and salt.

Dr Palanisami said micro plastics were an emerging contaminant and there was little specific data for Australia, but he would expect ingestion rates to be lower here due to lower seafood consumption rates and a cleaner environment.
He said the next phase of their research will be to better understand the human health impacts of ingesting plastics. "What is the real impact? This needs to be explored," Dr Palanisami said. "What will happen if you ingest 5g of plastic a week? Is it toxic or an inert material?"

The report titled No Plastic in Nature: Assessing Plastic Ingestion from Nature to People has been under consideration for academic publication, but was released early to coincide with WWF's campaign for action on plastic pollution.
A similar study by the University of Victoria in Canada was published in the Journal of Environmental Science and Technology last week.
It analysed 26 research papers and found that people are consuming at least 50,000 pieces of micro plastic a year.

WWF said the leakage of plastic into the environment and food chain has been met with an inadequate global response from governments. "These findings must serve as a wake-up call to governments," said Marco Lambertini, WWF international director general. "Not only are plastics polluting our oceans and waterways and killing marine life — it's in all of us and we can't escape consuming plastics. " We need urgent action at government, business and consumer levels, and a global treaty with global targets to address plastic pollution."

A WWF petition calling for a legally binding treaty on marine plastics pollution has so far gathering more than half a million signatures.
The group said that since 2000 the world has produced as much plastic as all the proceeding years combined, a third of which is leaked into nature.

It said 104 million metric tons of plastic could be released into the environment by 2030 unless drastic action is taken.

~Internet

Morse Decoder

Decoding Morse code represents a real challenge to the programmer; it's just so variable.

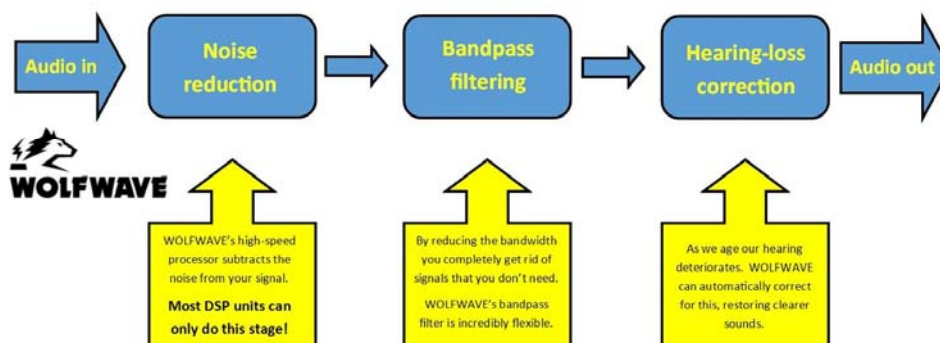People send it at differing speeds and with vastly differing "fists".

The ultimate decoder will always be the human brain but software can do a pretty good job.

We recently introduced a Morse decoder to our WOLFWAVE.

It already does noise reduction, bandpass filtering and age related hearing correction and now have added a CW reader.

Find out more about WOLFWAVE at https://www.sotabeams.co.uk/wolfwave-advanced-audio-processor/

MORSE CODE IS 175 YEARS OLD AND STILL AS USEFUL AS EVER

The first message sent by Morse code's dots and dashes across a long distance travelled from Washington, D.C., to Baltimore on Friday, May 24, 1844-175 years ago. It signalled the first time in human history that complex thoughts could be communicated at long distances almost instantaneously. Until then, people had to have face-to-face conversations; send coded messages through drums, smoke signals and semaphore systems; or read printed words.

Thanks to Samuel F.B. Morse, communication changed rapidly, and has been changing ever faster since. He invented the electric telegraph in 1832. It took six more years for him to standardize a code for communicating over telegraph wires. In 1843, Congress gave him $30,000 to string wires between the nation's capital and nearby Baltimore. When the line was completed, he conducted a public demonstration of long-distance communication.

Morse wasn't the only one working to develop a means of communicating over the telegraph, but his is the one that has survived. The wires, magnets and keys used in the initial demonstration have given way to smartphones' on-screen keyboards, but Morse code has remained fundamentally the same, and is still—perhaps surprisingly—relevant in the 21st century. Although I have learned, and relearned, it many times as a Boy Scout, an amateur radio operator and a pilot, I continue to admire it and strive to master it.

Easy sending

Morse's key insight in constructing the code was considering how frequently each letter is used in English. The most commonly used letters have shorter symbols: "E," which appears most often, is signified by a single "dot." By contrast, "Z," the least used letter in English, was signified by the much longer and more complex "dot-dot-dot (pause) dot."

In 1865, the International Telecommunications Union changed the code to account for different character frequencies in other languages. There have been other tweaks since, but "E" is still "dot," though "Z" is now "dash-dash-dot-dot."

The reference to letter frequency makes for extremely efficient communications: Simple words with common letters can be transmitted very quickly. Longer words can still be sent, but they take more time.

Going wireless

The communications system that Morse code was designed for—analogue connections over metal wires that carried a lot of interference and needed a clear on-off type signal to be heard—has evolved significantly.

The first big change came just a few decades after Morse's demonstration. In the late 19th century, Guglielmo Marconi invented radio-telegraph equipment, which could send Morse code over radio waves, rather than wires.

The shipping industry loved this new way to communicate with ships at sea, either from ship to ship or to shore-based stations. By 1910, U.S. law required many passenger ships in U.S. waters to carry wireless sets for sending and receiving messages.

After the Titanic sank in 1912, an international agreement required some ships to assign a person to listen for radio distress signals at all times. That same agreement designated "SOS"—"dot-dot-dot dash-dash-dash dot-dot-dot"—as the international distress signal, not as an abbreviation for anything but because it was a simple pattern that was easy to remember and transmit. The Coast Guard discontinued monitoring in 1995. The requirement that ships monitor for distress signals was removed in 1999, though the U.S. Navy still teaches at least some sailors to read, send and receive Morse code.

Aviators also use Morse code to identify automated navigational aids. These are radio beacons that help pilots follow routes, traveling from one transmitter to the next on aeronautical charts. They transmit their identifiers—such as "BAL" for Baltimore—in Morse code. Pilots often learn to recognize familiar-sounding patterns of beacons in areas they fly frequently.

There is a thriving community of amateur radio operators who treasure Morse code, too. Among amateur radio operators, Morse code is a cherished tradition tracing back to the earliest days of radio. Some of them may have begun in the Boy Scouts, which has made learning Morse variably optional or required over the years. The Federal Communications Commission used to require all licensed amateur radio operators to demonstrate proficiency in Morse code, but that ended in 2007. The FCC does still issue commercial licenses that require Morse proficiency, but no jobs require it anymore.

Blinking Morse

Because its signals are so simple—on or off, long or short—Morse code can also be used by flashing lights. Many navies around the world use blinker lights to communicate from ship to ship when they don't want to use radios or when radio equipment breaks down. The U.S. Navy is actually testing a system that would let a user type words and convert it to blinker light. A receiver would read the flashes and convert it back to text.

Skills learned in the military helped an injured man communicate with his wife across a rocky beach using only his flashlight in 2017.

Other Morse messages

Perhaps the most notable modern use of Morse code was by Navy pilot Jeremiah Denton, while he was a prisoner of war in Vietnam. In 1966, about one year into a nearly eight-year imprisonment, Denton was forced by his North Vietnamese captors to participate in a video interview about his treatment. While the camera focused on his face, he blinked the Morse code symbols for "torture," confirming for the first time U.S. fears about the treatment of service members held captive in North Vietnam.

Blinking Morse code is slow, but has also helped people with medical conditions that prevent them from speaking or communicating in other ways. A number of devices—including iPhones and Android smartphones—can be set up to accept Morse code input from people with limited motor skills.

There are still many ways people can learn Morse code, and practice using it, even online. In emergency situations, it can be the only mode of communications that will get through. Beyond that, there is an art to Morse code, a rhythmic, musical fluidity to the sound. Sending and receiving it can have a soothing or meditative feeling, too, as the person focuses on the flow of individual characters, words and sentences. Overall, sometimes the simplest tool is all that's needed to accomplish the task.

~Internet

5G EXPLAINED

WHAT IS 5G?
5G is the 5th generation of mobile networks, a significant evolution of today's 4G LTE networks. 5G is being designed to meet the very large growth in data and connectivity of today's modern society, the internet of things with billions of connected devices, and tomorrow's innovations. 5G will initially operate in conjunction with existing 4G networks before evolving to fully standalone networks in subsequent releases and coverage expansions.

5G uses radio waves or radio frequency (RF) energy to transmit and receive voice and data connecting our communities.

In addition to delivering faster connections and greater capacity, a very important advantage of 5G is the fast response time referred to as latency. Latency is the time taken for devices to respond to each other over the wireless network. 3G networks had a typical response time of 100 milliseconds, 4G is around 30 milliseconds and 5G will be as low as 1 millisecond. This is virtually instantaneous opening up a new world of connected applications.

WHAT WILL 5G ENABLE?
5G will enable instantaneous connectivity to billions of devices, the Internet of Things (IoT) and a truly connected world.

5G will provide the speed, low latency and connectivity to enable a new generation of applications, services and business opportunities that have not been seen before.

There are three major categories of use case for 5G:

Massive machine to machine communications – also called the Internet of Things (IoT) that involves connecting billions of devices without human intervention at a scale not seen before. This has the potential to revolutionise modern industrial processes and applications including agriculture, manufacturing and business communications.

Ultra-reliable low latency communications – mission critical including real-time control of devices, industrial robotics, vehicle to vehicle communications and safety systems, autonomous driving and safer transport networks. Low latency communications also opens up a new world where remote medical care, procedures, and treatment are all possible

Enhanced mobile broadband – providing significantly faster data speeds and greater capacity keeping the world connected. New applications will include fixed wireless internet access for homes, outdoor broadcast applications without the need for broadcast vans, and greater connectivity for people on the move.
For communities, 5G will enable the connection of billions of devices for our smart cities, smart schools and smart homes, smart and safer vehicles, enhance health care and education, and provide a safer and more efficient place to live.

For businesses and industry, 5G and IoT will provide a wealth of data allowing them to gain insights into their operations like never before. Businesses will operate and make key decisions driven by data, innovate in agriculture, smart farms and manufacturing, paving the way for cost savings, better customer experience and long term growth.

New and Emerging technologies such as virtual and augmented reality will be accessible by everyone. Virtual reality provides connected experiences that were not possible before. With 5G and VR you will be able to travel to your favourite city, watch a live football match with the feeling of being at the ground, or even be able to inspect real estate and walk through a new home all from the comfort of your couch. 5G will keep us connected in tomorrow's smart cities, smart homes and smart schools, and enable opportunities that we haven't even thought of yet.
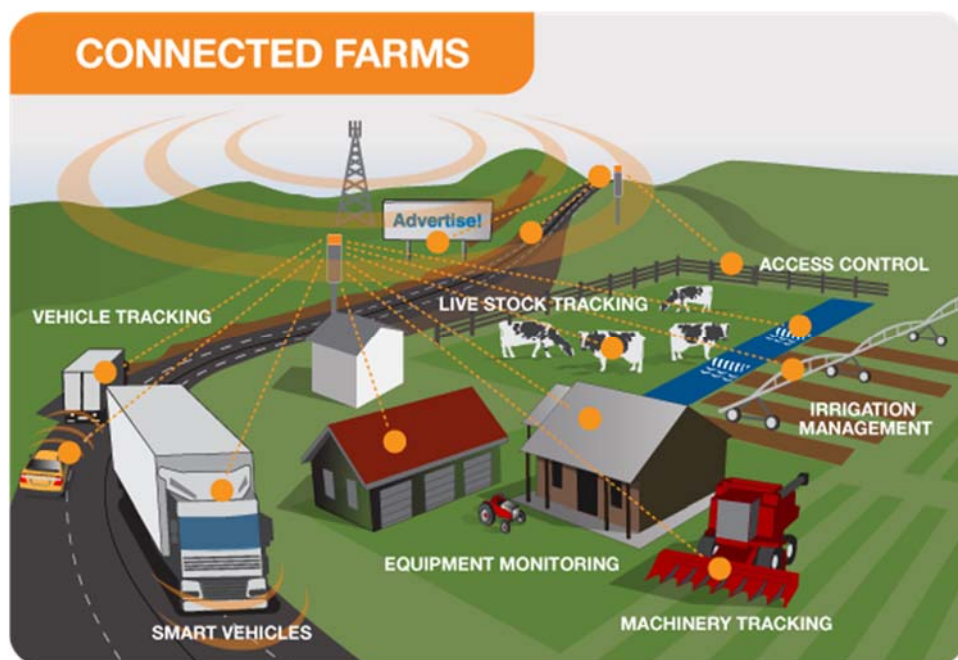
5G Enhanced Mobile Broadband and IoT will revolutionise agriculture and farming.

WHEN WILL 5G BE READY?
5G is currently being developed and trialled ready for commercial launch from 2020.

WHAT WILL BE THE FIRST APPLICATIONS FOR 5G?
Fixed wireless access for homes and enhanced mobile broadband services are likely to be the first applications using new 5G wireless access modems and hot spots.

WHAT WILL 5G DEVICES OFFER?
The prime benefits of 5G devices will be significantly faster speeds in data access, downloading and streaming content. In addition, 5G devices will have increased computing power and make use of the lower latency, meaning that the devices will enjoy virtually instantaneous connections to the network, as well as greater connectivity when on the move due to the use of advanced antenna beam steering.

HOW DOES 5G WORK?
Most operators will initially integrate 5G networks with existing 4G networks to provide a continuous connection.
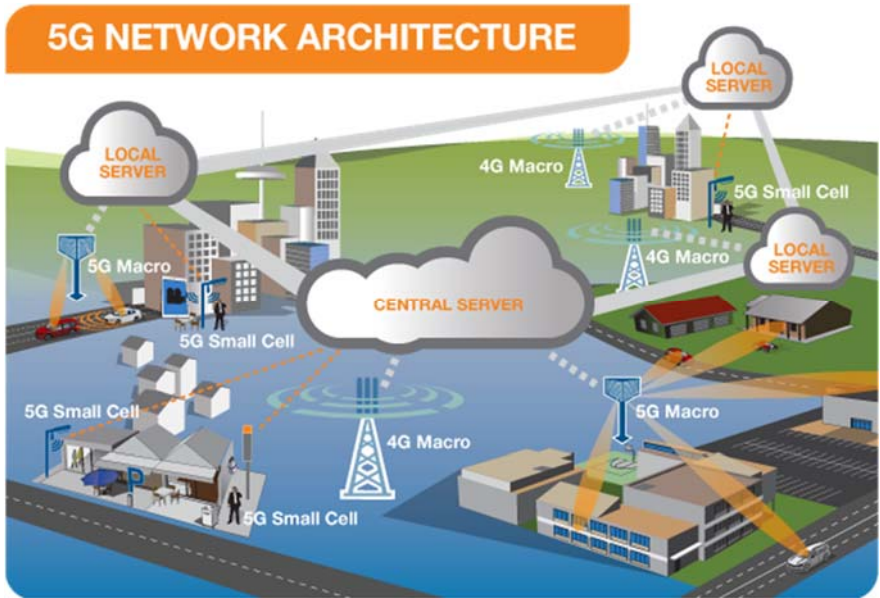
5G network architecture illustrating 5G and 4G working together, with central and local servers providing faster content to users and low latency applications.

A mobile network has two main components, the 'Radio Access Network' and the 'Core Network'.

The Radio Access Network - consists of various types of facilities including small cells, towers, masts and dedicated in-building and home systems that connect mobile users and wireless devices to the main core network.

Small cells will be a major feature of 5G networks particularly at the new millimetre wave (mmWave) frequencies where the connection range is very short. To provide a continuous connection, small cells will be distributed in clusters depending on where users require connection which will complement the macro network that provides wide-area coverage.

5G macro cells will use MIMO (multiple input, multiple output) antennas that have multiple elements or connections to send and receive more data simultaneously. The benefit to users is that more people can simultaneously connect to the network and maintain high throughput. MIMO antennas are often referred to as 'Massive MIMO' due to the large number of multiple antenna elements and connections however the physical size is similar to existing 3G and 4G base station antennas.

The Core Network - is the mobile exchange and data network that manages all of the mobile voice, data and internet connections. For 5G, the 'core network' is being redesigned to better integrate with the internet and cloud based services and also includes distributed servers across the network improving response times (reducing latency). Many of the advanced features of 5G including network function virtualization and network slicing for different applications and services, will be managed in the core.

The illustration below shows examples of local cloud servers providing faster content to users (movie streaming) and low latency applications for vehicle collision avoidance systems.

5G network architecture illustrating 5G and 4G working together, with central and local servers providing faster content to users and low latency applications.
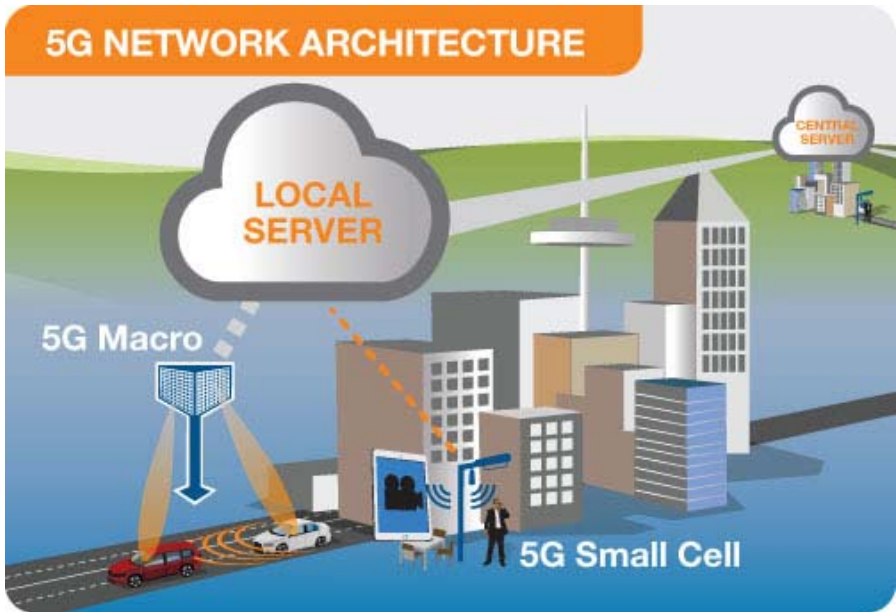

Example of a local server in a 5G network providing faster connection and lower response times

Network Slicing – enables a smart way to segment the network for a particular industry, business or application. For example emergency services could operate on a network slice independently from other users.

Network Function Virtualization (NVF) - is the ability to instantiate network functions in real time at any desired location within the operator's cloud platform. Network functions that used to run on dedicated hardware for example a firewall and encryption at business premises can now operate on software on a virtual machine. NVF is crucial to enable the speed efficiency and agility to support new business applications and is an important technology for a 5G ready core.

5G WORKING WITH 4G
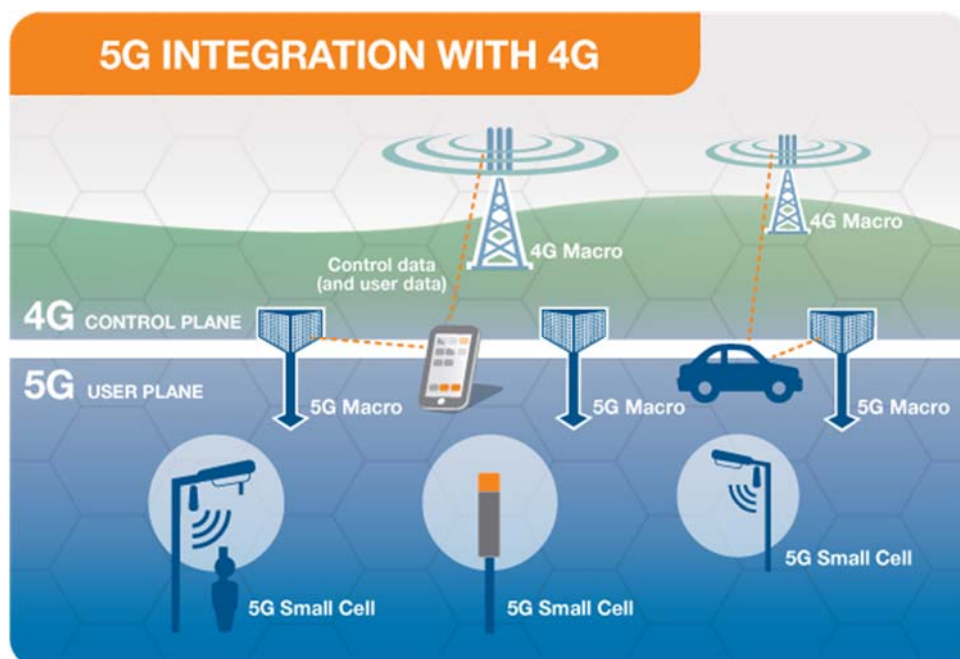
When a 5G connection is established, the User Equipment (or device) will connect to both the 4G network to provide the control signalling and to the 5G network to help provide the fast data connection by adding to the existing 4G capacity.
Where there is limited 5G coverage, the data is carried as it is today on the 4G network providing the continuous connection.
Essentially with this design, the 5G network is complementing the existing 4G network.

HOW DOES 5G DELIVER CONTINUOUS CONNECTION, GREATER CAPACITY, SPEED AND RESPONSE TIMES?

5G networks are designed to work in conjunction with 4G networks using a range of macro cells, small cells and dedicated in-building systems. Small cells are mini base stations designed for very localised coverage typically from 10 metres to a few hundred metres providing in-fill for a larger macro network. Small cells are essential for the 5G networks as the mmWave frequencies have a very short connection range.
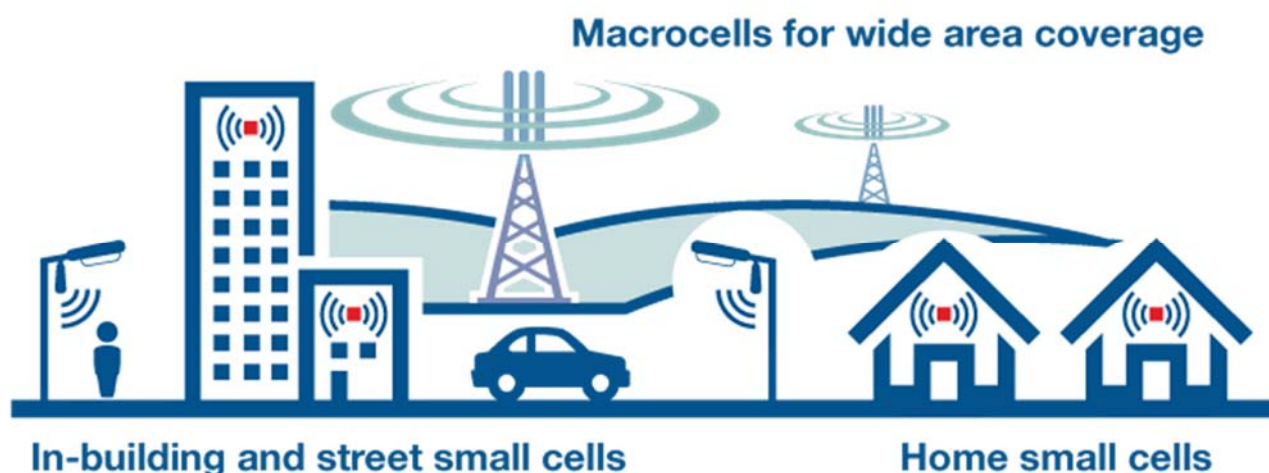
INCREASED SPECTRUM – GREATER CAPACITY, MORE USERS AND FASTER SPEED
Initial frequency bands for 5G are proposed around 600-700 MHz, 3-4 GHz, 26-28 GHz and 38-42 GHz which will add significantly more capacity compared to the current mobile technologies. The additional spectrum and greater capacity will enable more users, more data and faster connections. It is also expected that there will be future reuse of existing low band spectrum for 5G as legacy networks decline in usage and to support future use cases.

The increased spectrum in the millimetre (mm) Wave band above 30 GHz will provide localised coverage as they only operate over short line of sight distances. Future 5G deployments may use mmWave frequencies in bands up to 86 GHz.
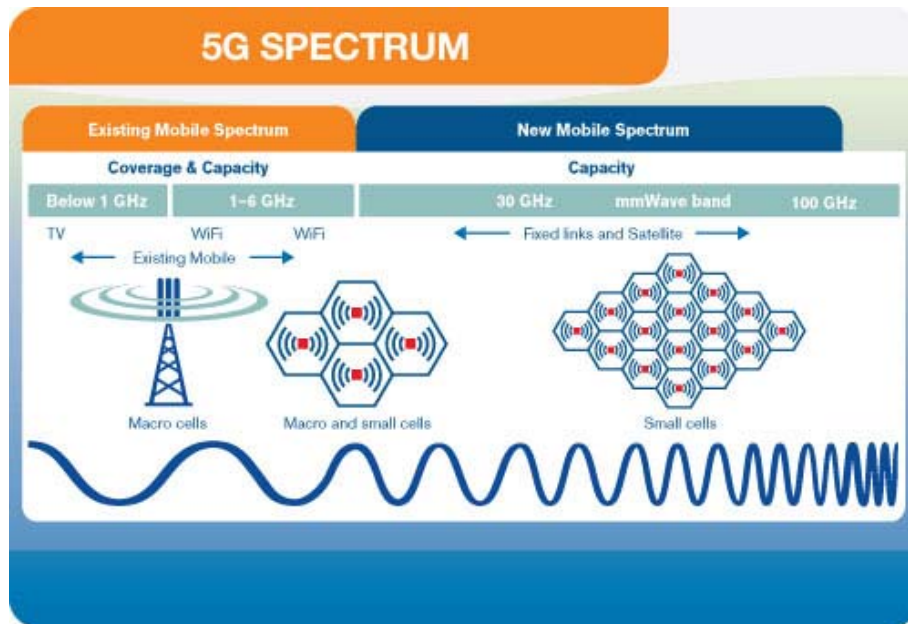
Mobile spectrum showing the radio frequency range from 3-100 GHz with new 5G spectrum above 6GHz.
Other radio services (TV, Wi-Fi, Fixed links & Satellite) are shown for reference.

MASSIVE MIMO - multiple element base station - greater capacity, multiple users, faster data

5G will use 'Massive' MIMO (multiple input, multiple output) antennas that have multiple elements or connections to send and receive more data simultaneously.   The benefit to users is that more people can simultaneously connect to the network and maintain high throughput.

The overall physical size of the 5G Massive MIMO antennas will be similar to 4G, however with a higher frequency, the individual antenna element size is smaller allowing more elements (in excess of 100) in the same physical case.

5G User Equipment including mobile phones and devices will also have MIMO antenna technology built into the device for the mmWave frequencies.
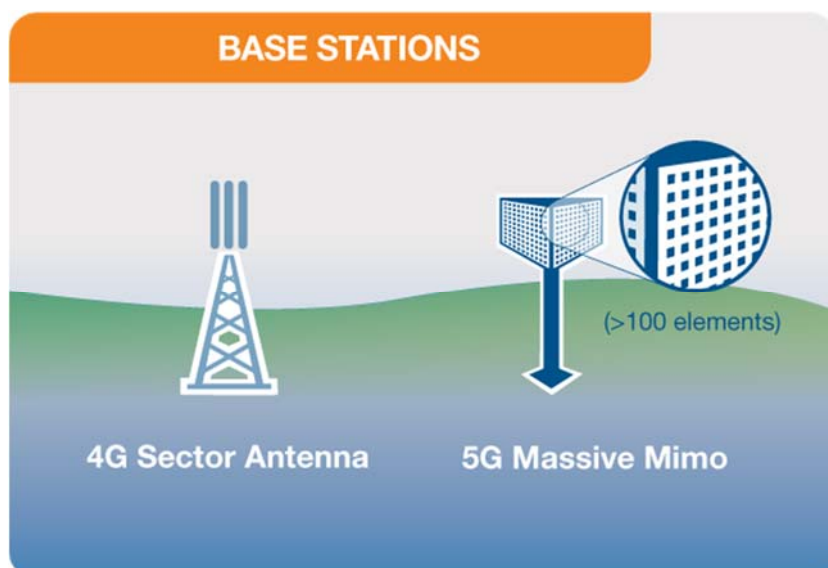
4G sector base station and 5G base station with a new multi element Massive MIMO antenna array. The overall physical size of the 5G base station antenna is expected to be similar to a 4G base station antenna.

MIMO - Beam Steering

Beam steering is a technology that allows the Massive MIMO base station antennas to direct the radio signal to the users and devices rather than in all directions. The beam steering technology uses advanced signal processing algorithms to determine the best path for the radio signal to reach the user. This increases efficiency as it reduces interference (unwanted radio signals).
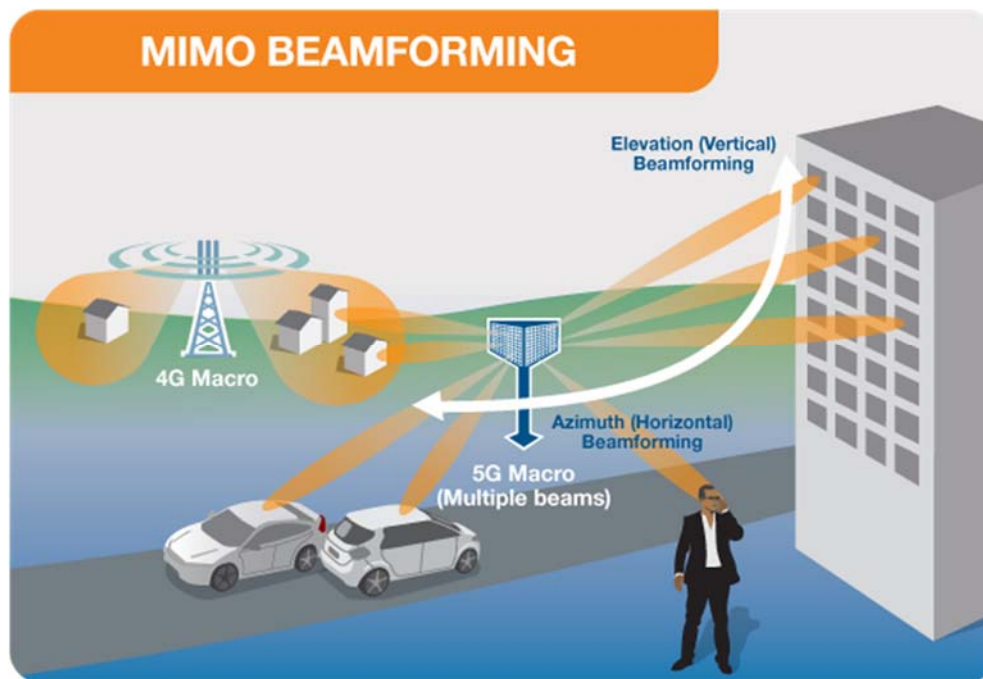
Massive MIMO antenna and advanced beam steering optimises EMF and increases efficiency.

LOWER LATENCY - FASTER RESPONSE TIMES

Lower latency with 5G is achieved through significant advances in mobile device technology and mobile network architecture.

Technology	Response time (milliseconds)
4G - LTE systems	20-30 ms
5G - enhanced mobile broadband	4-5 ms
5G - URLLC (Ultra Reliable Low Latency Communications) systems	1 ms

5G Network - Mobile Network Architecture Significant changes in both the Core Network (Core) and Radio Access Network (RAN) are required to deliver low latency.

Core Network Changes With the redesigned core network, signalling and distributed servers, a key feature is to move the content closer to the end user and to shorten the path between devices for critical applications. Good examples are video on demand streaming services where it is possible to store a copy or 'cache' of popular content in local servers, so the time to access is quicker.

Radio Access Network Changes To achieve the low latency, the Radio Access Network (RAN) will need to be re-configured in a manner that is highly flexible and software configurable to support the very different characteristics of the types of services that the 5G system envisages.

Low latency and high reliability over the air interface requires new radio techniques to minimise the time delays through the radio within a few TTIs (time transmit intervals) along with robustness and coding improvements to achieve high degrees of reliability (e.g. one message is delayed or lost in every billion).

Implementing a virtual, dynamic and configurable RAN allows the network to perform at very low latency and high throughput, but it also allows the mobile network to adjust to changes in network traffic, network faults and new topology requirements.

What will be re-configured? The new architecture will exist as a 4G/5G split RAN where the user plane (5G) and the control plane (4G) are separate. This requires the separation of general purpose hardware and specialised network hardware. The functionality of general purpose hardware (nodes) are suitable for network functions virtualisation (NFV), where the specialised hardware in the RAN will become dynamically configurable.

What is 5G internet & when will it arrive in Australia?

5G is the natural progression of 4G mobile internet, but this next generation looks set to be a big one. Pundits say it could deliver speeds up to 20 times faster than the fastest fixed line internet in Australia, so it has some big claims to its name already. Access to 5G services is scheduled to begin in mid-to-late 2019, depending on your telco, but isn't likely to be completed until well into 2020. Interestingly, fixed wireless customers may be among the first to see the benefits of 5G in Australia, connecting to a hub that then connects to a 5G data service.

Telstra is already on-board, having switched on 5G mobile sites across Sydney and Melbourne in late 2018. Australia's largest telco boasts 187 5G-ready stations across Australia, with more being added in time for the 2019 launch. The only downside is that we still have to wait until the first 5G-ready mobile phones hit the market, but Telstra has already confirmed it will stock 5G-capable devices from Samsung, LG, and OPPO throughout 2019.

Not long after Telstra's big announcement, Optus came to the 5G game after launching a 5G home broadband plan. For $70 per month ($1,690 over two years), this will be available to select customers who can apply for early access via an 'expression of interest' program. The first 5G rollout was focused in three locations, with two suburbs, Manuka and Dickson, in the ACT and Glendenning in Sydney. Optus will continue to establish 5G sites across Australia throughout 2019.

In comparison, the NBN rollout is due to be completed nationally by 2021. So overall, the turn of the new decade could see a dramatic uptick in internet speeds across Australia, thanks to the combined adoption of the NBN and 5G cellular networks.

In the meantime, 4G data is still widely available as an on-the-go alternative to fixed broadband. Below is a list of 4G mobile broadband plans with at least 30GB data on board, listed in price order. These are featured products.

5G Vs NBN: What could be better for home internet?

Aside from speed comparisons, what ends up being better for home internet could entirely depend on which provider you're with, and what technology they're backing. However, there is no reason that 5G and NBN cannot complement each other – like how 4G is used for mobile applications, and NBN services home internet needs today.

While Telstra and Optus have not been coy about their support for 5G, the third big carrier in Australia, Vodafone, is a bit more reserved in its approach to 5G. CEO Inaki Berroeta has downplayed the hype, saying that the new spectrum will not realistically be available for a few years, and that in that time NBN could gain even further ground. Nevertheless, Vodafone is building its own 5G network and aiming to have it up and running in 2020.

Vodafone is the newest of the 'Big Three' telcos to offer NBN plans, while Optus and Telstra have had their offers available for some time, offering broadband along with entertainment bundles, discounts, and deals. While it may seem Vodafone is backing down on the NBN hype, its CEO did push the 'co-existence' model, rather than 5G taking over NBN or vice versa. Although some think that 5G might be the death of the NBN, the broadband network is certainly not going away.

While 5G may not totally replace the NBN, that doesn't mean you shouldn't get a little excited about it. With up to 20Gbps download speeds a theoretical possibility, Australia could experience a whole new world when it comes to the internet. And as the big telcos begin to roll out their 5G networks, and with 5G phones soon to hit the market, there isn't long to wait until we can test out the new tech ourselves.

It will be interesting to see how the many telcos and Mobile Virtual Network Operators (MVNOs) receive 5G and what they'll charge for it. Nevertheless, 5G has the potential to revolutionise internet in Australia – but don't count out NBN just yet.

~Internet

Home phone landlines on a steepening path to extinction

The rise of the mobile phone has already started to kill off the home landline but the NBN is likely to accelerate the move to extinction with only half of Australians expected to still have a home phone line by 2021.

According to comparison site Finder's research into Australian Communication and Media Authority data, landlines will be nowhere to be seen by 2037.

The number of Australians still holding on to a landline has decreased consistently over the years.

It dropped from 83 per cent in 2011 all the way down to 64 per cent in 2017 and, on this trajectory, it will be down to half by 2021.

There is still a large number of Australians who are holding onto landlines in case of an emergency or a blackout.

Almost one in six – that's 15 per cent – say they only have a landline for their Internet connection with another 13 per cent saying they have a home phone but never use it.
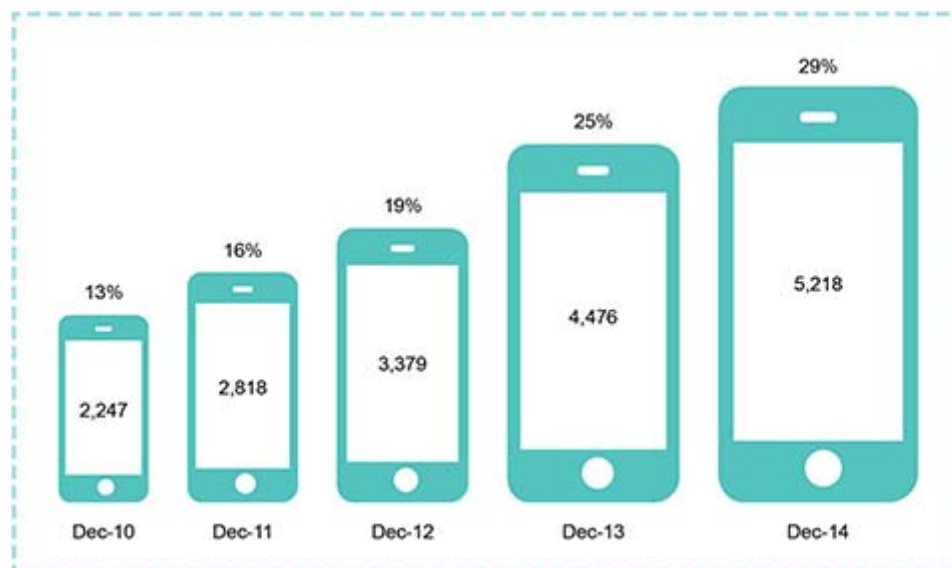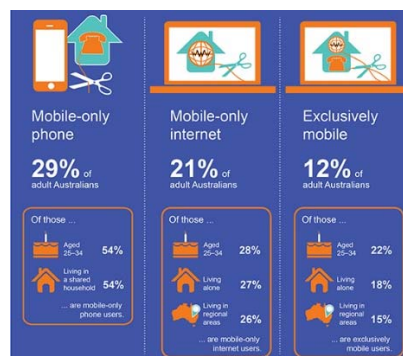
Growth of the mobile-only phone user, December 2010 to December 2014

Many users also under the false impression you have to keep voice services to get the Internet on their existing landline.

And with the rollout of the NBN, customers are now taking a long hard look at whether they actually need to keep a landline at all.

And even if you do want to hang onto a home number, the NBN will connect you using VoIP (voice over Internet protocol).

But it's the penetration of mobile phones in Australia that will see landlines eventually disappear.

The quality of our mobile networks and the convenience of having your phone wherever you go has been a major factor in the inevitable decline of the landline.

~Internet

WIA responds to ACMA five-year work plan

The Wireless Institute of Australia (WIA) has submitted a detailed response to the Australian Communications and Media Authority's (ACMA) consultation draft of its work plan over the next few years to 2023.

The Five-year Spectrum Outlook for 2019–23 (FYSO) sets out the spectrum management work that the ACMA plans to do over that period. The draft FYSO was launched in April.

Various topics of high interest to the radio amateur community are included in the FYSO and the WIA has responded, accordingly. The key topics include:

- review of amateur licensing in the context of the single licensing system being brought in
- consultation on proposed amateur licence conditions
- advancing the 5.3 MHz – or 60 metre – band allocation
- licence terms and fees framework.

The WIA has told the ACMA it is concerning that amateur licensing issues are being considered when the foreshadowed new Radiocommunications Act is not in place and there is little or no indication about how the new Act will deal with delegations, regulations and codes of practice.

Accordingly, the WIA reiterated that the radio amateur community requires:

- individual licences bearing a unique callsign
- certainty of licence tenure
- an equitable framework of transaction costs – that is, fees
- certain and continuing access to frequency bands throughout the radiofrequency spectrum
- and continuing participation and representation in spectrum management processes.
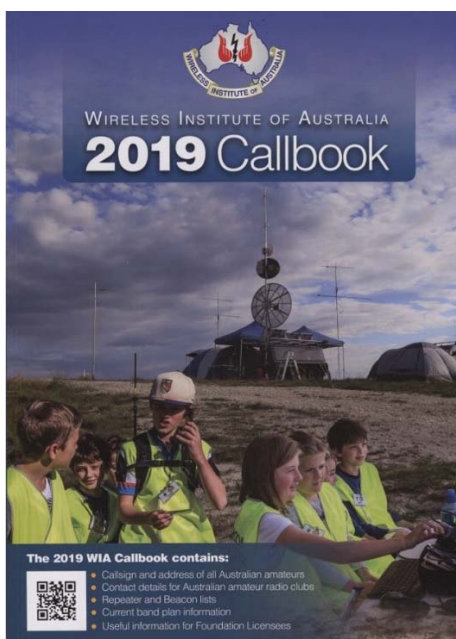
2019 Callbook is out and found at ARV & WIA & Hamfests
https://shop.amateurradio.com.au/product/wia-2019-callbook/
http://www.wia.org.au/members/bookshop/page_data.php?id=262

Artificial intelligence: 10 ways society will change by 2050

Leading Australian artificial intelligence scientist Professor Toby Walsh is warning that we are "sleepwalking" into an AI future in which billions of machines and computers will be able to think. Professor Walsh, from the University of New South Wales, is calling for a national discussion about whether society needs to adopt clear boundaries and guidelines around how AI is developed and how it's used in our lives.

In his book It's Alive: Artificial Intelligence From The Logic Piano to Killer Robots, he has highlighted key questions in a series of predictions that describe how our future could be far better or far worse because of AI.

Here's how he thinks society might change by 2050 thanks to artificial intelligence.

1. You are banned from driving

Humans drive drunk, tired and distracted and cause 95 per cent of accidents.
From truckies to lawyers and doctors, artificial intelligence will change every job and profession. The roads will be much safer without human drivers and most likely far less congested, as networked vehicles service passengers 24/7.
Street parking and most car parks will disappear, transport will be cheaper and groups such the elderly and disabled will have greater personal mobility.

Most people won't bother buying cars and will lose driving skills. And autonomous vehicles will arrive quickly — within 15-20 years.
"By 2050, the year 2000 will look as quaintly old-fashioned as the horse drawn era of 1900 did to people in 1950," Professor Walsh said.

2. You see the doctor daily

Your personal 24/7 AI doctor will know your gene sequence and vulnerabilities to particular diseases.
It will continually monitor your blood pressure, sugar levels, sleep and exercise. It will process data from your toilet, which will automatically analyse your urine and stools.
Your future version of a smartphone or fitness watch will regularly take selfies to identify melanomas and eye disease. It will record your voice for signs of a cold, dementia or a stroke. It will call for help if you faint. It will also be a trillion-dollar global business.
"Our personal AI physician will have our life history, it will know far more about medicine than any single doctor, and it will stay on top of all the emerging medical literature," Professor Walsh said.

3. Marilyn Monroe is back in the movies

Avatars will be programmed to act and talk like anyone we choose in interactive movies, including ourselves or celebrities from recent history. Where the story goes depends on what you do or say. Hollywood and the computer games industry will merge and immerse us in hyper-real worlds. But there will be increasing concern about the seductive nature of these unreal, alternate worlds. There may be an underclass of addicts who spend every waking moment in them. And some who behave in distasteful or illegal ways. "This problem will likely trouble our society greatly," Professor Walsh said.
"There will be calls that behaviours which are illegal in the real world should be made illegal or impossible in the virtual."

4. A computer hires and fires you

That's just the beginning. AI systems will also increasingly take over managing how you work: scheduling your activities, approving holidays, monitoring and rewarding your performance. But should we hand over decisions like hiring and especially firing to a computer? "We will have to learn when to say to computers: 'Sorry, I can't let you do that.' It's not enough for a machine to do a task better than a human. There are some decisions we simply should not allow machines to make."

5. You talk to rooms

You will walk into a room and say "lights on" and "who won the football?" and one of the many AI devices in your house will recognise your voice and understand you well enough to know which football code you follow.

A few people will resist and determinedly follow a disconnected 20th Century life. But most of us will take advantage of having just about everything in our lives connected: fridges, toasters, baths, door locks, windows, bicycles and pot plants.
AI will operate through the so-called Internet of Things using conversation instead of typing.
"Our privacy, diversity and democracy will be challenged," Professor Walsh said.

"Government intelligence agencies can't wait for every room to be listening to us. Marketers, too, would love all this data about our everyday lives. "So, the next time you get asked to check your privacy settings, think long and hard about what you may be giving up."

6. A robot robs a bank

Cyber-crime to date has been relatively low-tech with phishing and malware attacks. But AI will surpass human hackers — and the only defence will be another AI program. Warfare is also moving into cyberspace. But these technologies will also quickly find their way into the civilian sphere. One of the challenges will be that many advances in AI used to defend systems will be quickly turned around to attack systems.

"The supposed hacking by Russians in order to influence the 2016 US presidential election demonstrates the impact that such cyber-attacks can have," Professor Walsh said. "Banks [and other companies and governments] will have no choice but to invest more and more in sophisticated AI systems to defend themselves from attack."

7. World soccer champions lose to a robot team

Robots will have superior ball skills, including unfailing accuracy in passes and penalties.
They will know precisely where all players are at all times and will know how to interpret that information because their AI system learned strategic play from watching every World Cup match ever recorded.
The human team will be soundly defeated. Even fans of the robots will call for the humans to be given a break. That's why most sporting teams will stay human.

But AI will change football and most other games with managers and players using AI to train and play better.
"Data scientists will be some of the best paid members of football [and other sporting] clubs," Professor Walsh said.
"Scouts will hang out at [top universities] to recruit young computer scientists."

8. Ghost ships, planes and trains cross the globe

The oceans, skies and railroads of the planet will be filled with autonomous ships, planes and trains transporting cargo without any people on board, as driverless car technology spreads to other industries.
It will improve safety and efficiency. And children will no longer grow up wanting to be train drivers.
"Planes carrying people will probably continue to be piloted by humans," Professor Walsh said.
"But after several decades of safe flights by cargo planes, the debate will begin whether humans should still be airline pilots."

9. TV news is made without humans

Nearly every part of this prediction is already here — it's just that no-one has yet pulled all the pieces together.
Computers now write simple sport and financial stories but as technology improves, AI will write more complex stories.
Avatars and chatbots will play the role of presenters filmed by robotic cameras. And the news you watch will be narrowcast, or tailored to your personal preferences.

"There will be ongoing debate about the biases of algorithms, especially when humans take no part in deciding what news we see," Professor Walsh said.

"Our viewpoints are shaped by the lens through which we look at the world. Will algorithms challenge us enough? Will they understand lies and deception? Will they care about what we care about?"

10. Humans live on after death

It will be common to leave behind an AI chatbot that will talk like you, know the story of your life and comfort your family when you die. Some people might give their chatbot the task of reading their will; settling old scores; or relieving grief through humour.
Digital doubles will also appear in place of the living. Celebrities will use bots to create social media; many of us will similarly use them to manage our diaries.

This digital outsourcing will fuel a lively debate.

Professor Walsh asked: "What redress do you have against an AI bot that pretends to be you? Do you have a right know if you're interacting with a computer rather than a real person?
Should AI bots be prohibited from political discourse?
Who can switch off your bot after you die?
Do bots have freedom of speech?
It will be an interesting future."

~Internet

25 Signs That You Are Completely Addicted To Your Phone

Almost 52% of the mobile phone users will show all of these 25 signs of serious phone addiction.
What about you?
There is no doubt that life without phones would be difficult.
We need them for daily purposes including socializing, making and receiving important calls, staying in touch, and the like.
However, some people know and understand that excessive usage of phones is not good for health.
In fact, it could lead to numerous health and social disorders including brain cancer.
Nonetheless, it is easy for people to get addicted to their phones, especially because smart phones these days have so much to offer.

Here are 25 signs that show that you might be addicted to your phone:

1. You have your phone in your hand 24/7

Chances are that if you are completely addicted to your phone, you will always keep your phone in your hand or somewhere close to you. People who are addicted will always, or in most of the instances, be seen with their phones, either chatting away, being on call, or using some random app or the other. It is difficult for such people to part with their phones for a long time for they can have a panic attack even if they feel for a second that they have lost their phone.

2. Not a day goes by that you are without your phone

People who are addicted to their phones will not be able to live without it even for a day.
If, by mistake, they ever leave their phones at home and realize midway that they did, then they will make it a point to go back home and fetch it. These people need to have their phones with them constantly, without which they feel incomplete.

3. Your phone battery does not even last a day

You will know that you are addicted if you always find yourself charging your phone multiple times in a day.
While smart phones are heavily equipped with a lot of apps and other entertainment sources, they consume a lot of battery, especially if used continuously. Data transfers used by most entertainment and social apps tend to drain the battery extremely fast.

4. When you are running out of battery, you run for your charger

Do you find yourself running after your charger instantly as soon as you get that low battery notification every time?
If so, then you might be addicted to your phone.
Some people are so obsessed with their phones that they will use it constantly until their battery is running out and then immediately run for the charger to charge it before their phone dies on them.
In some of the cases, they will sit right next to where their phone is charging so that they can use it as it charges.

5. You worry about losing your cell phone

Cell phone addicts are constantly worried about losing their phones, and they will most likely have a panic attack if they lose their phones even for as little as one second.
Being constantly worried about losing your phone is certainly not a healthy behavior, and hence indicates clear signs of addiction.

6. You take your phone to the bathroom

If you are addicted to your phone, then chances are that you would take it everywhere with you, even to the bathroom.
If a person starts taking his/her phone to the bathroom, then he/she will normally take longer than usual to come out, since he/she will become all too consumed with the phone inside.

7. You are on your phone in social settings

Social settings and occasions are meant to be enjoyed, and the purpose of these settings is to talk to the people all around you instead of being on your phone. However, most of the times, the people at social gatherings are glued to their phones.
If you are on your phone more often at these social gatherings, then chances are that you are addicted to your phone.

8. You check your phone constantly, in most cases without any reason

People who are addicted to their phones will check them constantly without any reason.
They just feel the need to be on their phones, even though they are not expecting an important message or phone call.
In some cases, people even feel phantom vibrations of their phones.

9. The first thing you do after getting up in the morning, and the last thing you do before going to sleep at night, is check your phone

Do you find yourself checking your phone as soon as you wake up in the morning and as soon as you are about to fall asleep at night?
If so, then you might just be heavily addicted to your phone.
Keeping your phone close to or right next to you while you sleep can cause serious disruptions to your sleeping patterns.
Therefore, this behaviour is not healthy.

10. Even while getting ready to sleep you feel the need to check your phone

Addicted people want to check their phones all the time, even while they are preparing to go to sleep.
They will then be in their beds and using their phones until they fall asleep, either going through random apps or talking to someone.

11. Vacation time is more like an extended phone time for you

Most people would spoil their whole vacation by being on their phones instead of spending quality time there and enjoying the different place that they are at.
There is no point of a vacation if you remain on your phone constantly there as well.
You might as well then just stay at your home and use your phone there, at least that would save you from wasting any money.

12. You obsessively check for emails, texts, and missed calls

People who are addicted to their phones will become obsessive about missed calls, texts, and emails.
They will check their phones even while engrossed in other work or during important meetings.

13. You start feeling your phone vibrate just to find out later that it was a false alarm

Such false alarms are known as phantom vibrations where a person might assume their phone to have vibrated just to find out later that it was a false alarm.
People start experiencing phantom vibrations particularly when they have become obsessively addicted to their phones.

14. You carry it in your hand instead of your bag or pocket

If you are addicted to your phone, then chances are that you will be carrying it in your hand instead of your pocket or bag in most of the cases. Keeping your phone in your hand constantly can also lead to addiction, since then you have better access to it and you will be turning the screen on and off without any reason.

15. You turn to your phone whenever things get awkward

Do you find yourself relying on your phone a little too often whenever things get awkward?
If your answer is yes, then you are probably addicted to your phone.
Sure, the phone can be your savior every once in a while, but if you find yourself relying on it a little too often, then you might just have a problem.

16. You HAVE to reply to messages even while you are getting a massage and trying to de-stress

Most people would be using their phone even when they are at a spa and trying to de-stress and melt away their worries for the day.
People get a massage for relaxation purposes, and phones are one of the primary stress causing machines.
Therefore, in order to unwind properly, it is essential that the phones are kept as far away as possible during the process.

17. You are currently reading this article on your phone

If you are a phone addict, then chances are that that you are reading this article on your phone.
Most people who are phone addicts would browse the web and do all their online related tasks on their phones instead of using their laptops or desktops.

18. Dressing up for an important occasion can wait, but your phone can't

Phone addicts would normally be on their phones until the last minute, even if they have to dress up for an important occasion.
Their phones are extremely important to them and they would be on it all the time.
Once they are completely satisfied with the amount of time they have spent on their phones, only then will they get off their couch or bed to get ready for their special occasion.

19. You're on your phone even while watching TV or eating food

Phone addicts will most likely be on their phones while they are watching TV or eating food. This also means that they will be more focused on their phones as opposed to being focused on the aspect at hand, i.e. food or TV. For them, consuming food or watching TV is a secondary activity to using their phones.

20. You procrastinate on important work with your phone

If you are a phone addict, then you would probably procrastinate on all your important work with your phone.
Smart phones can be very addictive, and people would normally be on them no matter how important their other tasks would be.
Even while performing other tasks, phone addicts would need to use their phones in the middle of their work.

21. You have a panic attack if you leave your phone at home

Being a phone addict means that you have to have your phone with you at all times.
When addicts leave their phones at home by mistake, they might have a panic attack the moment they realize it.
In most of the cases, addicts will make sure that they have their phone with them before they leave their home.

22. You do not mind responding to messages or checking your phone while on a date

Dates are meant to be occasions where you give your undivided attention to the person you are with.
However, with phone addicts, the situation might be a little different.
They will keep checking their phones and responding to messages even while they are out on a date.
Such behaviour definitely seems rude to the other person, especially if they want to talk to you and get to know you better.

23. For you, your phone is one of the most important experiences that you treasure

If you are a phone addict, then you would most likely crave being on the phone a little too much.
Your phone will thus be one of the most important experiences for you, and you will most likely treasure those experiences.
It is also likely that you will treasure these experiences more than the actual events that are happening around you.

24. You get lost in your phone without realizing how much time you have wasted

Phone addicts would most likely get lost in their phones all the time without even realizing that they have wasting so much time on it.
Once they are on it, it is hard for them to get off it, and in some cases, they might even have to force themselves to get off it.

25. You will be caught using your phone during exams or an important meeting

If you are a phone addict, then chances are that you will be caught using your phone while you are sitting through an exam or attending an important meeting.
Exams and meetings are not places where phones should be used as you could get into a lot of trouble for it.
However, addicts just cannot seem to help themselves and they will use it whenever they get their hands on it.

Phone addicts usually show most, if not all, of these 25 signs that are stated above.
While phone addiction is very much real, very few people are actually aware about their addiction.

This essentially means that they will keep about their addiction unknowingly, and thus would not do anything to reduce its effects.

It is not that difficult to get rid of your phone addiction, provided that you take the necessary steps and seek help, either professionally or from the people around you.

~Internet

NEVARC Nets

40M Net
Monday, Wednesday and Fridays
10am Local time (East coast)
7.095 MHz LSB
Approximately + or - QRM
Hosted by Ron VK3 AHR

80M Net

Wednesday 20:30 Local time
3.622 MHz LSB
Hosted by Ron VK3 AHR
Using the club call VK3ANE

2M Nets

Monday at 2000 local time on
VK3RWO repeater
146.975 MHz

Will your signal be heard?
Try Proppy HF Circuit Prediction: Point-to-Point
https://soundbytes.asia/proppy/p2p

Kit fun.
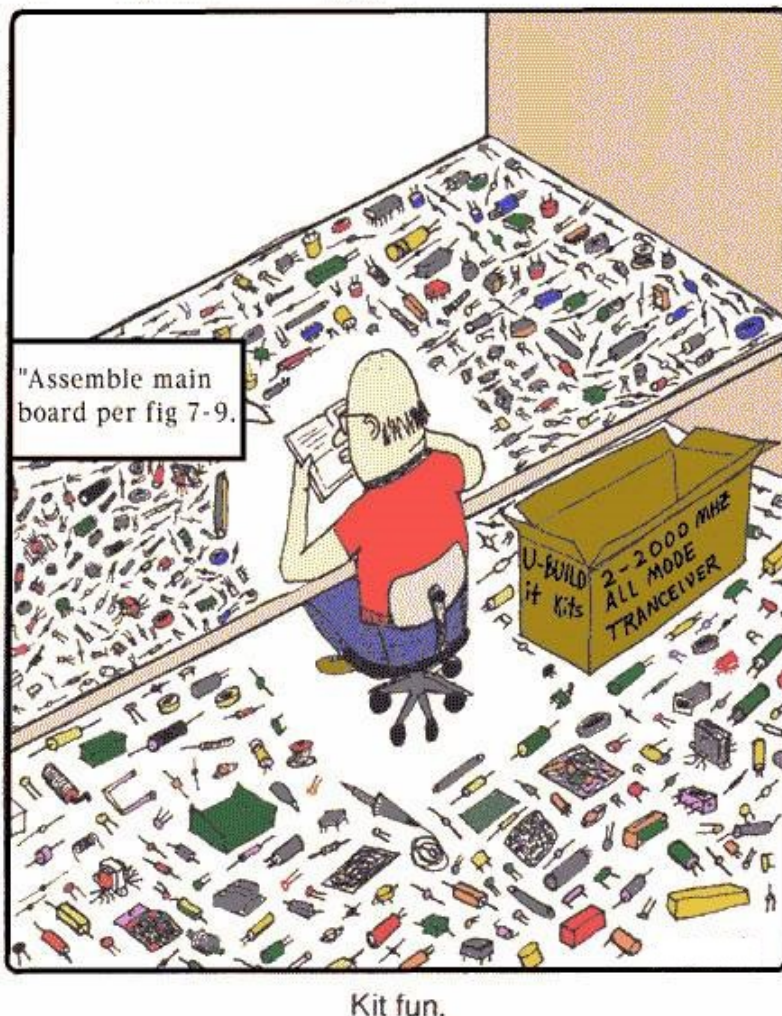
PICTURES FROM SPACE VIA HAM RADIO

Have you ever wanted to receive a radio signal from space? It's fun and a lot easier than you might think!
The Raspberry Pi magazine MagPi have published a guide to receiving amateur radio Slow Scan TV pictures from the International Space Station.
MagPi magazine @TheMagPi tweeted: "we've updated our guide on how to receive and decode these transmissions. It now includes a fall back mode in case there are any (TECHNICAL) issues."
Read the article at https://www.raspberrypi.org/magpi/pictures-from-space-via-ham-radio/

~WIA News

ATV OR NOT TV

How to find hidden cameras in your Airbnb, and anywhere else.
In recent months there's been a number of alarming reports of Airbnb hosts installing hidden cameras in their properties but not disclosing them to the guests staying there. Back in January, Fast Company, reported on a computer science professor who discovered two hidden cameras recording him and his family in an Airbnb. And just last month The Atlantic reported on a New Zealand family who was renting an Airbnb in Ireland and found they were being live-streamed from a hidden security camera.
If you see an alarm clock in a bathroom or some other place you wouldn't expect one to be, that could be a tip-off that something is amiss. Similarly, if you see any devices, such as a USB wall plug pointed directly at a bed or shower, something could be up.

Now many of we hams are into 'fox hunting' so Smartphone users can use apps like "FING" that display all the wireless devices connected to a Wi-Fi network. So after arriving at your Airbnb and connecting to the host's wireless network, whip out Fing and give that network a sniff. It'll show your device and any other connected to that same network.
https://medium.com/fast-company/how-to-find-hidden-cameras-in-your-airbnb-and-anywhere-else-d1de793f7ddc

~WIA News

Superflare could cause technology blackout on Earth

The sun could wipe out humanity within the next 100 years when it unleashes a huge "superflare".

The storm of deadly radiation threatens to take out all technology on Earth, potentially causing trillions in damage and sending the planet into chaos.

Scientists have repeatedly warned of the danger superflares pose to mankind, and in a new study predict one will hit us in the next century.

"Our study shows that superflares are rare events," lead expert Dr Yuta Notsu, from the University of Colorado Boulder, USA said.

"But there is some possibility that we could experience such an event in the next 100 years or so."

Superflares are massive bursts of energy from the surface of a star.

They're the high-powered version of the solar flare — regular and largely harmless bursts of solar energy that cause the Northern Lights.

Previously, scientists thought our sun, which is old and inactive as far as stars go, couldn't produce superflares.

But by looking at the solar activity of distant stars, researchers have now found our sun is capable of the huge energy bursts.
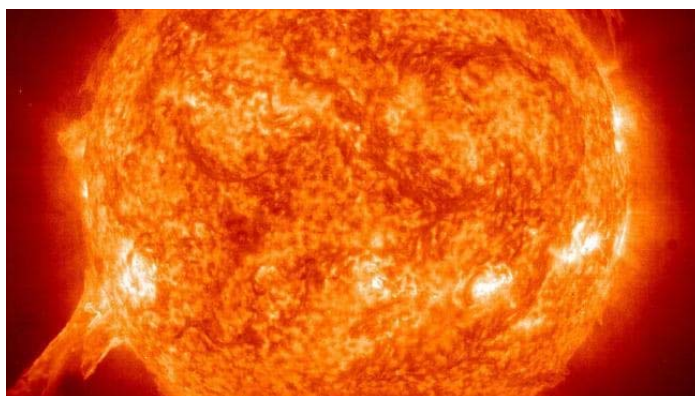
A solar flare shown erupting from the sun in 2002. Picture: NASA's SOHO satellite

Using Nasa's Kepler Space Telescope, the team spotted older stars like our own pumping out solar flares hundreds of thousands of times more powerful than anything detected on Earth.

If a superflare erupted from the sun, our planet would likely sit in the path of a wave of high-energy radiation.

Such a blast would pommel Earth's magnetic field, disrupting electronics across the globe, causing widespread blackouts and shorting out communication satellites in orbit.

The study's results should be a wake-up call for life on our planet, Dr Notsu said.

"When our sun was young, it was very active because it rotated very fast and probably generated more powerful flares," he added.

"But we didn't know if such large flares occur on the modern sun with very low frequency."

A number of scientists have warned that humanity needs to better prepare itself for a potential major solar storm.

Insurer Lloyd's of London reckons the damage from such an event, lasting between one and two years, would range between $600 billion and $2.6 trillion.
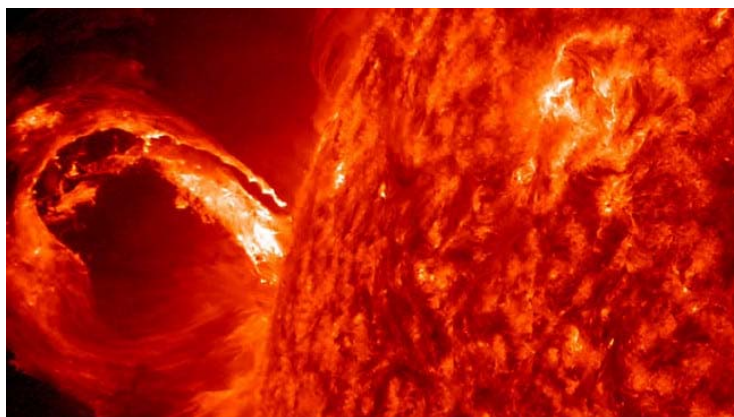
Scientists now believe the sun is capable of producing a superflare. Picture: NASA and Scienceworks

Even small solar storms in modern times have been known to lead to widespread blackouts in Sweden and Canada.

In 2012, a huge coronal mass ejection which could have decimated electronics missed the Earth by just nine days.

The event was comparable to the 1859 Carrington Event, in which telegraph operators suffered electric shocks and sparks exploded from pylons. Experts warned in March that an "enormous" solar storm capable of wiping out Earth's satellites and electronics is "around the corner".

Devastating space storms could strike Earth at any time and we'd only have 15 minutes' notice.

Stephen Hawking once said the Earth would become a sizzling fireball by 2600 and humanity would become extinct.

~Internet

Mathematical winters: Ada Lovelace, 200 years on

Christmas 1840, cold and crisp. The fashionable and wealthy Lovelace family are learning to skate, the four year-old Byron (junior, the grandson of Lord Byron) pushing a chair along the ice to keep his balance.

Driven inside by the cold, his mother retires to her study and her lessons in advanced calculus. She writes to her tutor: "This is very mathematical weather. When one cannot exercise one's muscles out of doors, one is peculiarly inclined to exercise one's brains indoors." Then she plunges into a detailed discussion of the convergence of series.

Her name is Ada, Countess of Lovelace.

Her teacher was Augustus De Morgan, one of the foremost mathematicians of the day.

She is studying the material he taught his advanced class at the then all-male University College London: he writes of her power of thinking as "utterly out of the common way", capable of grasping the "real difficulties of first principles".

This grounding in advanced mathematics was essential for Ada Lovelace's most famous work, a paper published in 1843, which translated and considerably extended a work by please by Luigi Menabrea about a general-purpose mechanical computer designed by Charles Babbage, his unbuilt analytical engine.

The substantial appendices written by Ada Lovelace contain an account of the principles of the machine and a table often described as "the first computer programme". Lovelace presents the machine, not in terms of ironmongery, but as what we would now call an "abstract machine", describing the functions of memory, CPU, registers, loops and so on.

Diagram for the computation of Bernoulli numbers, Ada Lovelace 1842

What is truly remarkable to the modern computer scientist is her high-level view. She understands the complexity of programming, the difficulty of checking correctness and the need for programme optimisation. She reflects on the power of abstraction, how the machine might "weave algebraical patterns", how it might work with quantities other than number and its potential for creativity. In what Turing later described as "Lady Lovelace's objection" to whether machines can think, she observed that: "The Analytical Engine has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform."

Ada, Countess of Lovelace, was born Ada Byron on 10 December 1815, the daughter of the poet Lord Byron and his wife Annabella (nee Milbanke), and died after a long and painful illness in 1852. In 1833 she married William King, who was created Earl of Lovelace in 1838.

Although her parents separated when she was a few months old and she never knew her famous father, his notoriety as "mad, bad and dangerous to know" has often overshadowed accounts of her life.

From an early age, Lovelace showed a passion and a talent for mathematics and science. Her mother was a noted educational reformer and organised her own daughter's education on the principles of Pestalozzi.

This involved the study of mathematics, French and music accompanied by childhood visits to factories and workshops.

This later helped Lovelace grasp the mechanical principles of Babbage's calculating machines, which she first encountered in her teens.

In later life, Lovelace continued to pursue her mathematical interests. She contributed to her husband's writings on crops and husbandry, proposing a quadratic, rather than a linear, model to relate growth of plants to quantity of sunlight.

She followed the latest scientific trends, like photography and mesmerism, and even suggested that collecting amateur photographs of mesmeric phenomena would aid scientific understanding – an early example of crowdsourcing.

She wanted to understand the workings of the mind and wrote about whether there might be mathematical laws underlying the operations of the brain, a "calculus of the nervous system".

Lovelace's name lives on through the Ada programming language as well as initiatives for women in science, including the annual "Ada Lovelace Day" in mid-October.

She has become a controversial figure, generating both wild enthusiasm and, in turn, a backlash of hostility, to extravagant claims that she foresaw quantum mechanics, invented the CD, or brought about Silicon Valley.

But there is no need to exaggerate – in her 200th year we should celebrate an extraordinary individual, who defied the constraints of her time and gave a remarkable and farseeing account of the principles, potential and challenges of computation.

We know so much about Ada Lovelace and her world because of a large archive of family papers held at Oxford's Bodleian Library. The wonderful insights they offer into her relations with her family and children, her variety of interests and her sometimes intense feelings, have perhaps obscured their contribution to the history of science and mathematics.

But Lovelace offers much further potential for true collaboration between the humanities and the sciences to understand the scientific and cultural context for the emergence of modern ideas of computation.

~Internet

Diode History

John Fleming's valve or diode (1904) allowed electrical current to flow in one direction only.
Courtesy: Science Museum/Science & Society Picture Library.

Fleming Diode

The diode is one of the oldest and most important electronic devices, although it is not as famous as its cousin, the transistor. Used in all sorts of electrical and electronic systems, the diode functions as a one-way valve for electric current—it only allows current to flow in one direction. This is useful in converting AC to DC, processing high frequency signals, regulating voltages, and in other applications. There are two basic types of diodes. One is an electron tube similar to the triode. The other type uses semiconductors, like the transistor. Both were invented early in the 20th century.

The first diode was a modified light bulb. Thomas Edison discovered that including an extra electrode in a light bulb and connecting it to the positive side of a battery resulted in a current flowing from the filament through the empty space.
He was not sure what to do with this discovery, and moved on to other projects.

Joseph J. Thomson (1856~1940) announced the discovery of the electron in April 1897 and explained the Edison effect where current travels just one way through a vacuum tube. Thompson received a Nobel prize in 1906.

Others found another use for this device. In the early 1900s, for example, English engineer John Ambrose Fleming used this one-way electrical "valve," to convert radio waves into a flow of current that could be measured by a galvanometer. The Fleming valve is remembered as the first true electronic device. It came into use for radio transmission and soon became the basis of Lee De Forest's Audion electron tube, which he invented in 1906.

Also around 1906, American engineer Greenleaf W. Pickard invented a new type of diode. Pickard based his design on the earlier discovery that electricity can flow in only one direction through certain types of mineral crystals, such as silicon. By placing a silicon crystal between a metal base and a carefully placed fine wire, Pickard created a valve that could also be used to detect radio waves. This type of "cat's whisker" diode (so-named because of the fine wire used in it) became more popular after American H. C. Dunwoody patented a version of it that used a material called carborundum.

Part of a 1920s cat's whisker diode that uses a small crystal of the semiconductor galena. A fine piece of wire—the "cat's whisker"—is touched on the surface until the "sweet spot" is located. The crystal then acts as a one-way valve for electrical current and can be used to separate a radio signal from its carrier wave. Courtesy: Lorne Clark.

In the early 1900s, cat's whisker diodes were widely used in radio receivers, as they were an improvement over electron tubes. But they too had limitations.
They required careful adjustment and could easily be knocked out of alignment.

For these reasons the use of cat's whisker diodes declined, although their ability to work at very high frequencies made them valuable during World War II when they were used in radar receivers. During the war years, thousands were manufactured, and in the course of research on semiconductors, Bell Laboratories scientists stumbled on a new type of diode.

Russell Ohl, a Bell Labs metallurgist working with silicon samples discovered that one of his samples acted like a diode and—even more remarkable—produced electricity in response to light. He had invented a new type of diode that was also an efficient solar energy converter or "cell." The reason it worked either as a diode or as a solar cell was a mystery to the researchers. Eventually, however, they determined that the sample, which had been cut from a larger piece of silicon, had a region that contained high levels of a certain kind of impurity. The area where this region joined the rest of the silicon formed a "junction." This junction had something to do with the diode action of the device. The junction and the different regions of impurity also allowed it to respond to light. It would be many years before physicists explained why this worked, but in the meantime, semiconductor junction diodes went into production, first as solar cells and eventually as ordinary diodes.
Today the variety of diodes and their uses have greatly expanded. Electron-tube diodes are rarely used, but silicon diodes are used in many types of equipment to detect high frequency electromagnetic waves, to convert sunlight into electricity, and many other purposes. Inside computers, televisions, and other familiar systems are diodes that help convert alternating current (AC) electricity to direct current (DC), and to regulate the level of the voltage. High-power diodes are used in automobiles, where they convert the AC from the alternator into DC that the battery and on-board electronics can use. Light emitting diodes (LEDs), perfected in the early 1960s, have replaced incandescent lamps for many purposes, and may soon replace the lamps used in car headlights and household light bulbs.

Historical Diodes (Rectifiers)
Here is a partial list of the type of diodes invented, constructed and used over time, many comprise of hazardous materials:
Chemical Rectifier, known as the Nodon Valve using lead and aluminium electrodes.
Copper type rectifier (used lead and copper junctions, also copper sulphide and magnesium junctions)
Selenium Rectifier, Electrolytic Rectifier, Gaseous Rectifier, Argon arc rectifier, Mechanical Rectifier, colloquially known as the vibrator, obsoleted from industrial applications around 1921, but used in vacuum tube mobile radio equipment up until 1958.
Also a rotational synchronous rectifier
Mercury Arc Rectifier, also Mercury Vapour Rectifier
Photo diode tube, also photomultiplier, gamma ray detector

More recent solid state diodes:
Silicon Diode, Germanium Diode, Tunnel Diode, IMPATT Diode, Gunn Diode, Schottky Diode, Varacter Diode, Zener Diode, Light Emitting Diode, Photodiode, Silicon Controlled rectifier (SCR) Metal-Oxide-Metal Diode, invented around 1975, and a variant of the Schotty diode, *Used for detection and mixers into the near-infra-red wavelengths.*

S Tube Rectifier
The S Tube Rectifier.-The S tube rectifier has been developed by the American Radio and Research Corporation, and is often used by American amateurs instead of the usual form of two-electrode valve rectifier.
The anode is a flat carbon electrode, and the cathode is cup-shaped, with a small tube-like opening, as illustrated. The tube contains helium at about 12 mm. pressure.
When the anode is made positive, free electrons are drawn from all parts of the cup through the opening to the anode.
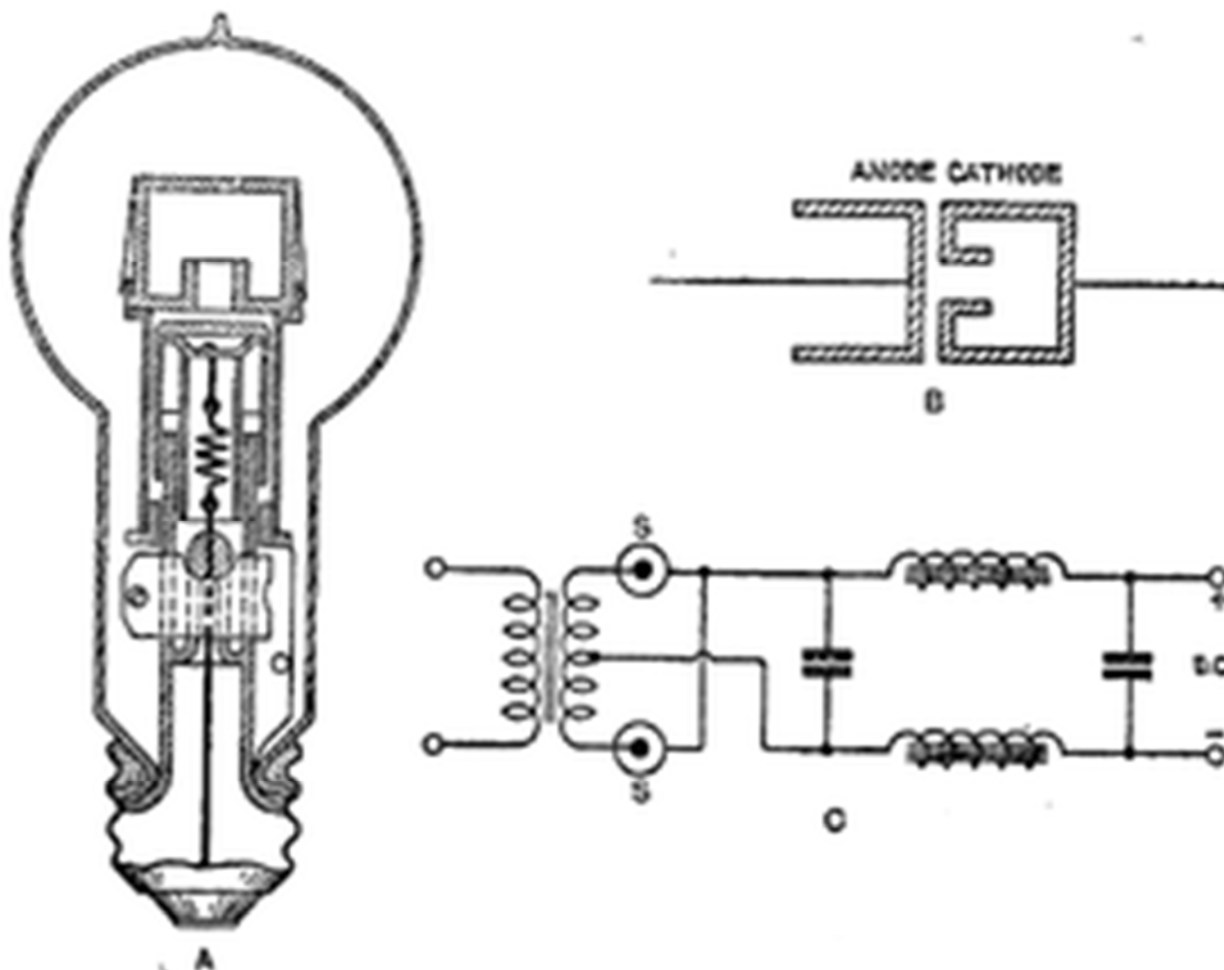
FIG. 112.—Explaining the S tube rectifier.

S Tube Rectifier circa 1922

In doing so they collide with the atoms of the helium and ionise them.
The action is cumulative, and hence the tube conducts.
When the cup is made positive the action is very different.
Positive ions in the cup, being much larger in bulk, are less mobile, and but comparatively few of them reach the cathode (cup).
The movement of the positive ions is so sluggish, and the number which reach the cathode so few, that the current conduction is less than 1 per cent. of the normal current carrying capacity when the polarity is reversed.

S tubes are manufactured for supplying D.C. anode potentials to 5-watt 1 transmitting valves.
They are rated at 20 watts each, the normal current being 50 milliamperes. The tube has a practically constant drop of 150 volts, and will stand 2,000 volts in the reverse direction. Two rectifier tubes will supply sufficient current for one 50-watt 1 transmitting valve.

Other old diodes were: Raytheon Rectifiers, Tantalum rectifier uses tantalum and lead electrodes, with sulphuric acid. Similar to the Nodon valve. Vacuum tube diode. Cats Whisker, uses crystalline galena (Lead sulphide), it can also use coal.
Crystalline Zinc Diode, exhibits negative resistance akin to the modern day tunnel diode

~Internet

The Wondrous Clock

Riddle:

A watchmaker was telephoned urgently to make a house call to replace the broken hands on a clock. He was sick so he sent his apprentice.

The apprentice was thorough. When he finished inspecting the clock it was dark.

Assuming his work was done, he attached the new hands and set the clock by his pocket watch. It was six o'clock, so he set the big hand at the 12 and the little hand at the 6.

The apprentice returned, but soon the telephone rang. He picked up to his angry client:

"You didn't do the job right. The clock shows the wrong time."

Surprised he hurried back. He found the clock showing not much past eight. He handed is watch to the client and showed her that her clock was not even one second late.

The client had to agree.

Early the next morning, the client telephoned to say the clock has apparently gone berserk, hands were moving around the clock at will. The apprentice again rushed over, the clock showed a little past seven. After checking his watch he yelled:

"You are making fun of me! Your clock shows the right time!"

Have you figured out what's going on?

Answer:

As the problem says the apprentice mixed up the hands so that the minute hand was short and the hour hand was long.

The first time the apprentice returned to the client was about 2 hours and 10 minutes after he had set the clock at six. The long hand had moved only from twelve to a little past two. The little hand made two whole circles and an additional 10 minutes.

Thus the clock showed the correct time.

The next day around 7:o5 a.m. He came a second time, 13 hours and 15 minutes after he had set the clock for six. The long hand, acting as the hour hand, covered 13 hours to reach 1.
The short handmade 13 full circles and 5 minutes, reaching 7, so the clock showed the correct time again.

~Internet

IF YOU GET KIDS INTERESTED IN AMATEUR RADIO

THEY WILL NEVER HAVE MONEY FOR ALCOHOL OR DRUGS

President, VK2VU, Gary
Vice President, Tom VK3NXT
Secretary, VK2FKLR, Kathleen
Treasurer, Amy

NEVARC CLUB PROFILE

History
The North East Victoria Amateur Radio Club (NEVARC) formed in 2014.
As of the 7th August 2014, Incorporated, Registered Incorporation number A0061589C.
NEVARC is an affiliated club of the Wireless Institute of Australia.

Meetings
Meetings details are on the club website, the Second Sunday of every month, check for latest scheduled details.
Meetings held at the Belviour Guides Hall, 6 Silva Drive West Wodonga.
Meetings commence with a BBQ (with a donation tin for meat) at 12pm with meeting afterwards.
Members are encouraged to turn up a little earlier for clubroom maintenance.
Call in Via VK3RWO, 146.975, 123 Hz tone.

VK3ANE NETS

HF
7.095 MHz Monday, Wednesday, Friday - 10am Local time
3.622 MHz Wednesday - 8.30pm Local time

VHF
VK3RWO Repeater 146.975 MHz – Monday - 8pm Local time
All nets are hosted by Ron Hanel VK3AHR using the club callsign VK3ANE

Benefits
To provide the opportunity for Amateur Radio Operators and Short Wave Listeners to enhance their hobby through interaction with other Amateur Radio Operators and Short Wave Listeners. Free technology and related presentations, sponsored construction activities, discounted (and sometimes free) equipment, network of likeminded radio and electronics enthusiasts. Excellent club facilities and environment, ample car parking.

Website:	**www.nevarc.org.au**	**Postal:**	**NEVARC Secretary**
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Facebook:	**www.facebook.com/nevicARC/**		**Wahgunyah Vic 3683**